WIRE & WIRE PRODUCTS

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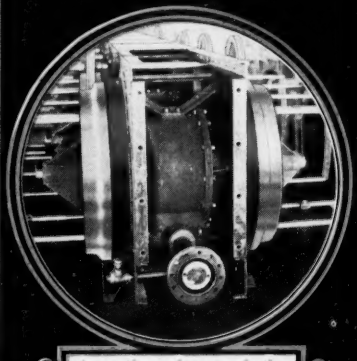

A section of one of the Vaughn Take-up Frames.

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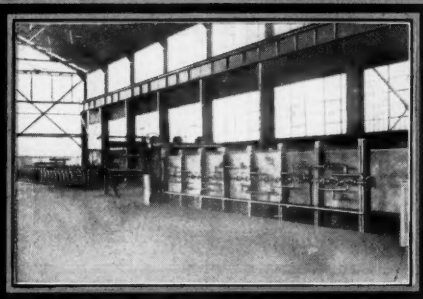
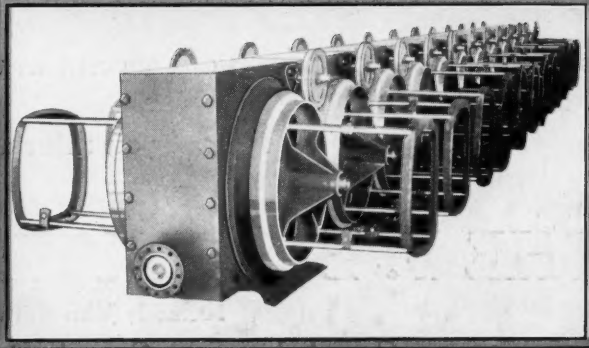


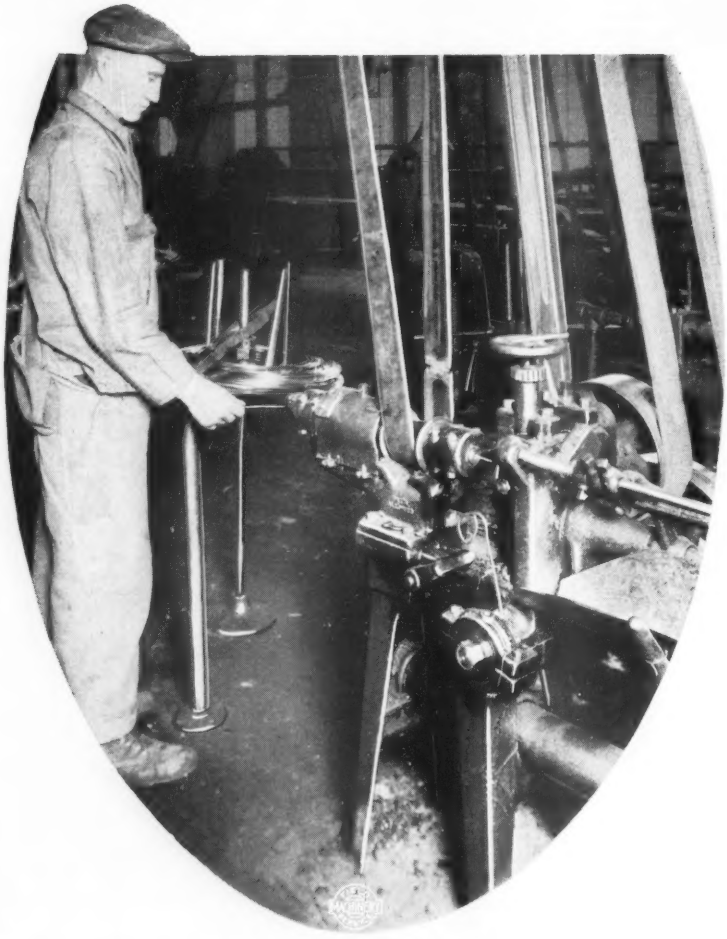
Furnace designed in cooperation with Surface Combustion Company



Showing method of construction—with enclosed individual gear cases for each cross shaft.

March 1928

Straightening and Cutting Off Brass Wire On a Shuster Machine



IN A LARGE Brass Plant in Connecticut, this Shuster Wire Straightening and cutting machine was installed some 8 or 10 years ago. Brass wire from .040" to .125" is straightened and cut on it, and when photographed it was operating on ⅛" diameter wire cutting to 10 feet lengths.

Several other Machines are also operating in this plant, and all giving satisfactory service which has been exceptionally free from interruptions, as only minor repairs have been necessary in all this time.

This is only one of hundreds of concerns in which Shuster Machines are saving time and money.

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THE F. B. SHUSTER COMPANY

Formerly John Adt & Son

Straightener Specialists Since 1866

NEW HAVEN, CONN.

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From American Brass Co., to U. S. Rubber Co., more than 100 Wire Mills buy Diamond Dies with PLENTY of Diamond.

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VIANNEY

Famous Wire Drawing Diamond Dies

EST. 1908

100 Fifth Ave., New York City

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 3 March, 1928 No. 3

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Not by Guaranteed Weight

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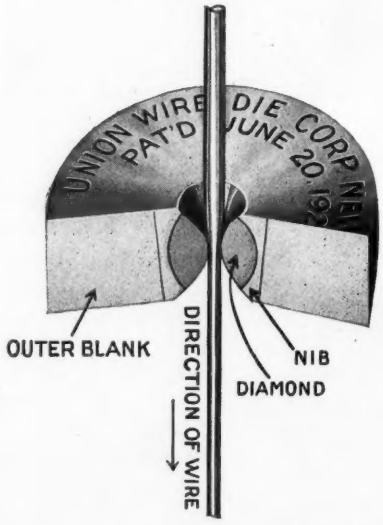
IN THE DRAWING OF WIRE, where Diamond Dies are the mediums, the TONNAGE of wire produced per die, is the outstanding feature.



Sectional View of round stone diamond die setting designed to resist drawing strains and the effects of vibration.

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UNION WIRE DIE CORP.

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WIRE & WIRE PRODUCTS

Vol. 3 MARCH, 1927 No. 3

Power Consumption and Flow of Metal in Wire Drawing

By J. D. Brunton

Brunton's Research Lab., Mussellbergh, Scotland

AS can be readily understood, the power required for wire-drawing is considerable, and the draft that can be taken on a piece of wire depends on the speed of drawing and the composition of the material. Since the introduction of the electric motor for wire-drawing, it has been much easier to arrive at the actual power taken. A number of readings have been taken with the idea of trying to arrive at the actual horse power necessary for drawing different sizes of wire, and a wide range of sizes and qualities of material were taken, and the following formula worked out:—

$$\text{Horse Power} = \frac{T \times (A-a) \times S \times F}{33{,}000}$$

where:

T=tensile strength of wire between the draw, expressed in lbs./sq. inch.

S=speed at which wire is drawn, in feet per minute.

A=area of wire before it is drawn, in square inches.

a=area of wire after it is drawn, in square inches.

F=the figure taken from the following table.

Reduction in area per cent	Factor "F"
10	3.0
15	2.5
20	2.25
25	2.15
30	2.0
35	1.75
40	1.6
45	1.5
50	1.25

Analysis of the Flow in Wire Drawing

There has been a considerable vagueness as to the behaviour of wire under strain and there has been a tendency to apply conclusions resulting from experiments carried out on specimens strained directly on a tensile test machine to other forms of cold work, such as wire-drawing without due regard to the differences involved. In order to make these differences between wiredrawing and actual straining of the material in a testing machine clear, a Mild Steel Bar was taken with the following composition:—

Carbon	0.1
Silicon	.03
Manganese	.28
Sulphur	0.02
Phosphorus	0.01

This rod was ¼" diameter and was thoroughly annealed at a temperature of 870 deg. C. and allowed to cool gradually in a furnace. The period of cooling was 12 hours. After this treatment the following results were obtained on a tensile test:—

Diameter	.247
Area	.0479

Maximum stress on section, 2239 lbs. which equals 20.6 tons sq. inch. Elongation on a length four times the square root of the area=.45"

Elongation Percentage 50

Reduction in area % 71

Another piece of the same rod was then gradually strained until a waste was formed with a minimum diameter of 0.151

Another piece of rod was drawn to .151 diameter by means of the wiredrawing process when it was found that the bar gave the following physical tests:—

diameter	.151
area	.0179,

maximum load in lbs. on sec-

tion 1460 lbs. which equals 36.4 tons per sq. inch.

Elongation on 4 times the square root of the area .10″

Elongation percent 19

Reduction in area 49%

These experiments show conclusively that under direct tensile strain the greatest flow takes place in the centre. In wiredrawing, however, the flow is different and in wire the elongation of the grain is very nearly uniform.

In order to explain this let us assume that there are N+1 crystals in a diameter line. The arrangement of the crystals will be

$$1;\ 2;\ 3;\ -\ -\ -\ \frac{N}{2}-1;\ \frac{N}{2};$$

$$\left(\frac{N}{2}+1\right);\ \frac{N}{2}+2;\ -\ \text{etc.}\ -\ N+1$$

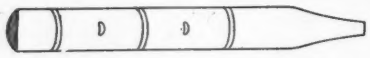
The centre crystal will then be N/2+1 as bracketed.

Under direct strain these crystals all tend to flow in the direction of the load, but actually only the centre N/2+1 crystal is able to flow entirely in this manner. This flow is purely due to slip on the cleavage planes and is analogous to wire drawing in an ideal form.

This crystal in being elongated is at the same time reduced in cross section and consequently vacates a position which is immediately taken up by the adjacent crystals N/2 and N/2+2 and so on out to 1 and N+1.

Thus in all the crystals, with the exception of N/2+1 there is a lateral movement as a whole entirely apart from the cleavage flow in the direction of strain. This lateral movement obviously increases toward the outside with a corresponding decrease in cleavage flow until the external crystals 1 and N+1 have little or no cleavage flow but maximum lateral displacement. Thus fracture will commence in the core and travel outwards.

In wire-drawing the flow is caused by the continued effect of lateral stresses and direct pull and when the wire is not too great in diameter the tendency to greater flow of the centre crystals due to direct strain, is counter-balanced by the greater effect of the lateral stresses on the outside crystals, and we get uniform flow or elongation of the grains. The larger the diameter of the rod, however, the greater becomes the external flow in comparison with the flow at the core. Thus the conditions in a thick bar drawn through a die are the reverse of those under direct tensile strain. While the above explanation is no doubt largely imaginative and cannot pretend to represent the exact behaviour of the metal crystals in a bar



Cross section of test rod showing flow of metal.

under load, since the mechanism of slip on the cleavage planes is much more complex than is actually suggested by the above; yet the explanation serves to illustrate our point.

In order to show the irregularity of flow in a thick bar, the following experiment was carried out. Several holes were drilled at regular intervals along a 7/8″ Mild Steel bar, .875″ diameter, these were plugged with 3/32″ brass, the plugs being normal to the longitudinal axis of the bar. The bar was then drawn to .780″ annealed and drawn to .750″ and finally to .687″ diameter. A longitudinal section of the whole bar was then made to show the position of the brass plugs. A portion of this is seen in the sketch above, which shows clearly that the lateral or partly tangential stresses have caused a backward flow on the outer portion of the bar.

From the above remarks it will be seen that modern wiredrawing is more than a mere skilled trade. Nor is its progress a matter of engineering science only, depending on the development of improved machinery, but also of metallurgical science. The growth of metallography has resulted in a great increase in our knowledge of the constitution of steel, and taught us much, among other things, regarding the behaviour of the metal crystals under plastic flow, and how this may be modified by chemical composition, heat-treatment, and mechanical treatment. The microscope has helped also to no small extent in elucidating the causes of many of the troubles encountered in wire-drawing, and shown us to some extent how these may be obviated. It has enabled us to tell with reasonable certainty whether the cause of brittleness, or poor physical properties in a wire, is due to the quality of the steel or to some faulty treatment in its manipulation. Errors in heat-treatment can now easily be detected, thanks not only to the possibility of actual examination of the faulty specimen itself but to research work which has already preceded it. True, the heat-treatment of wire had been studied before the advent of metallography, but its true significance cannot have been realised. What was discovered by experience to give the desired results has now been explained, and if our new knowledge has not always resulted in any very obvious improvements, it has at least helped us to adhere to the best methods of treatment, by telling us immediately when we have accidentally departed from them.

It is indeed difficult to lay one's finger on some definite point and say "here the application of science to industry has resulted in direct financial gain", but, apart from that sordid aspect of the subject, the gain to industry as a whole, and the improvement and increase of its products through the increase in knowledge due to the spirit of enquiry and pure research must be obvious to all who reflect. Those who are still sceptical regarding the advantages not only of routine laboratory control but of unceasing research in industrial operations, forget, or fail to realise, how much they themselves are endebted to its recognition by others.

So-Called Saturation Point One-Third Behind Sales Possibilities

Wire rope manufacturer finds way to increase sales by adding newspapers to business paper advertising schedules

By Ruel McDaniel *

THE Wire Rope Manufacturing & Equipment Company, Seattle, Washington, thought until a few months ago that its sales had virtually reached the "saturation point" in its logical trade territory, the Pacific Coast country. The owners were considering various plans to meet the problem. Whether to add new products to the line and by pushing them along with wire rope, maintain a normal increase in total sales, or to take things easy and hold the volume and prestige already attained, were the two important questions in mind. A third thought was to expand into bigger territory.

A New Appeal

Then someone suggested that there might be a possibility of increasing sales of wire rope through a radically different appeal right in the regular territory of the company. The suggestion was eventually carried to a definite advertising and selling schedule, with surprisingly favorable results.

This company started about six years ago to manufacture wire rope. As the principal rope-using industry in the Pacific Northwest was logging, the company aimed its product at this field. About four years ago the firm became a modest advertiser in West Coast lumber trade journals. Its featured rope is called the "Double Blue Line" and is made with a base of acid steel which is imported from Sweden. Knowing the lumber industry's demand for superior quality in all its supplies, the company early in its advertising began featuring Double Blue Line brand and playing up in all copy the acid steel base. Gradually through the consistent use of space in trade publications and the usual direct selling effort, the company built up an enviable following among the lumber industry. Without a doubt it stood out from among the other thirteen wire rope sellers in the territory. Some manufacturers would have been content with this prestige and apparent leadership, and there was for a time an indication that this company too was satisfied. But a survey of the market showed that although the lumber industry did consume by far the greater part of the rope used in the Northwest, there were other fields that were consistent users of wire rope of high quality. There were, roughly, about 300 good prospects in this classification, belonging to half a dozen different industries.

To the Man on the Street:
You may never buy a foot of wire rope, but you can know about it. This rope, made in Seattle, has shared up all records in logging, mining, contracting, stevedoring and many other fields.
On MERIT, the home product should and will win its local market. But if you know about it, "trust" for it, share pride in it, business will grow the more surely for your acquaintance and honestly recommendation.
A Credo for Pacific Northwest Products
Let us make it the Quality better, the Price more truly economical, the Service quicker and more personal; then, and only then, ask Local Loyalty to use our goods.
The Purchasing Agent Has Two Jobs
1. To get the best VALUE for his firm's money.
2. To buy as near home as he can as the money will increase local payrolls and purchases, and more quickly come back to his own firm.
As to 1: Double Blue Line Wire Rope gives superlative value. The Acid Steel has immense tensile strength and exceeds all specifications. It stands terrific torsions and shocks, is pliable over small sheaves, and resistant to Puget Sound salt air. Its "running in oil" lubrication lengthens its life materially. Because it is made in special "lays" or constructions for each use, it prevents shutdowns for repairs. It can be had in a matter of hours, with no traffic disappointments. The factory gives service; makes slings, puts in eye-splices and puts on anchor-bolts.
As to 2: This rope is made in Seattle. Three shifts of workmen live and buy here. We have receipts for $230,000 of local merchandise factory purchases for 1926. All this builds the Northwest; more buildings, roads, bridges, homes, telephones—things of everything.
"The Double Blue Line"
WIRE ROPE MFG. & EQUIPMENT CO.

The Small Buyer

And besides these, there was still another sales source, the survey showed. During the years the company had been advertising and selling wire rope, it had consistently appealed to the big user of rope. Here sales came easier because they came in large quantities. That meant low selling cost in comparison to the costs on small orders. The company and its product were well known among the big logging and lumbering firms in the territory, but the average individual, even in Seattle, knew little or nothing about the Wire Rope Manufacturing & Equipment Company and its Double Blue Line wire rope. The company had made no effort to become known by the "man in the street," for its lumber trade journal advertising did not reach him, nor did its salesmen have occasion to call upon him.

One day, relates George B. Gemmill, vice president of the company, a man from northern California was in

*Reprint from Sales Management, July, 1927

with a Seattle banker. This Californian chanced to mention that while in Seattle he expected to go out and place a sizable order for rope with the Wire Rope Manufacturing & Equipment Company. The banker did not intentionally discourage the visitor, for it is not the policy of any wide-awake banker to knock a local industry; but his surprise that a business man would come all the way from California to place a large order for rope with what the banker termed a little "jobbing" house, so rattled the visitor that he left without placing the order. By chance the company learned of this incident, and it was perhaps the most vital of the deciding factors that resulted in the extension of the company's sales and advertising appeal.

The truth of the matter was, the company had been a jobber of wire and machinery supplies for years in Seattle and it had become known for that. Nearly six years before it had started manufacturing wire on a large scale, but because it had made no effort to tell local business the fact, this banker still remembered the concern as just an ordinary sectional jobber and unintentionally killed a large order for a local firm.

Seeking Small Orders

UNTIL this incident pointed out to the management that the value of local prestige cannot be measured merely in actual dollars and cents as shown by sales reports, whatever orders for wire that came locally outside of the lumber and a few other industries that are big rope users, were considered so puny as not to warrant the expense of careful sales cultivation. What was the sales of 500 feet of small guy rope in comparison to 50,000 feet of the company's big Double Blue Line?

Finally, deciding that this source of small business was worth much more than at first valued, the company set aside $3,000 for a special advertising campaign to accomplish what the firm's sales and advertising policies had failed to accomplish in six years. It is rather remarkable, according to reports, the good this expenditure accomplished in performing the things which the firm had in mind to accomplish.

The campaign was intended to do two things: (a) Sell the 300 or so individual firms in the Northwest which were fairly large users of wire rope but which the company had not gone after because of their being in fields entirely different from those thus far covered; and (b) to sell the "man in the street" on the company and its Double Blue Line rope, whether the man appealed to ever would be in the market for rope or not.

The Results of German Research on the Annealing of Wire of Various Metals will be Published in an Early Issue of Wire and Wire Products

The Purpose of the Campaign

THE campaign accomplished three things. It did the two jobs intended and it appreciably strengthened the company and its product with the lumber and other major rope-consuming industries where the firm had been selling for six years.

The campaign ran in two important Seattle newspapers, both of which have an appreciable country circulation. Each advertisement was four columns wide by about twelve inches high, profusely illustrated.

The first advertisement created a mild sensation among local industrial lists by its unusual appeal. It read:

A CREDO
for Pacific Northwest
Products

Let us make the quality better, the price more truly economical, the service quicker and more practical; then, and only then, ask local loyalty to use our goods.

As the cry of the Pacific Coast has always been that people should patronize local manufacturers—use home-made products—this obviously caused a riffle among industrialists. It threw into the stock arguments so long advanced—loyalty to city and state and so on—an entirely new angle. It stated frankly that local manufacturers should first provide all the other things that make a local product preferable, then—and not until then—ask for local support from a loyalty standpoint.

This argument formed the body of the first advertisement; and it was reproduced in a small box in practically all the others. It was the keynote of the campaign, in a manner, and reached the very men to whom the firm wished to make itself known more prominently and favorably.

As a result of the comments this argument created, the company easily was able to have the Industrial Committee of the Seattle Chamber of Commerce officiate at the starting of a new stranding machine, which meant a good publicity story in local papers. On the strength of the interest the advertising and the visit of the committee created, Mr. Gemmill was invited to speak before the Industrial Division of the local chamber and tell them more of the company and its product. That in turn led to another talk before the local purchasing agents' association.

Building Local Prestige

BUSINESS men in all lines took the trouble to stop executives on the street or call them up and express surprise that there was such an industry of the size locally. One manufacturer stopped Mr. Gemmill and said, "I didn't know you fellows wanted business from the little fellow—the small user of wire rope. I knew you were out there, but I supposed that you went after only the big fellows.

Since you're advertising in the papers, however, I suppose you'd handle a little order like mine. I use about 1,500 feet of guy wire a year, and if that interests you, I'll be glad to give you the order."

"Well," Mr. Gemmill replied, "maybe you think your 1,500 feet of guy wire doesn't count for much alongside a big lumber order; but multiply that by fifty or a hundred such orders, and it amounts to a hundred thousand dollars or so. Isn't that worth going after?"

One executive who uses a few hundred feet of wire rope a year but who likewise had never thought of buying of the company complimented the firm on its credo, but added that what he would like to see was an advertisement showing the company's rope. He wanted to see what it looked like. It so happened that the next advertisement scheduled was dramatically illustrated with a piece of the completed rope occupying a third of the space. He'll always believe that his suggestion produced that copy!

Not only did business men in all lines comment on the copy, but several instances proved that the campaign further impressed loggers, lumbermen and others to whom the firm had been selling for five years, with the importance and quality of the product, by having the message brought to them in mediums additional to the trade magazines in which they had previously seen the firm's advertising.

A Forgotten Wire Mill

Ruins of Johnson, Gilmore & Sergeant wire mill on banks of the Croton river

By Charles G. Blandford

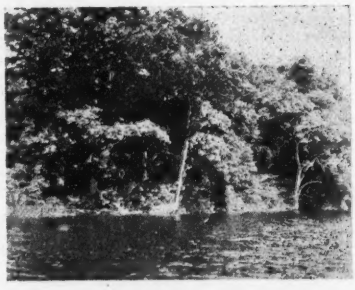
"TIME is a leveler of all things." This fact can no better be exemplified than by visiting at the present day the former site of the wire drawing mill of Johnson, Gilmore & Sergeant.

It is extremely doubtful if any are alive today, still active in wire manufacturing, who even remember that once a factory of considerably magnitude stood on the east bank of the Croton River in Westchester County, N. Y.

Unless the name identifies the location, many will wonder just where the Croton River is situated.

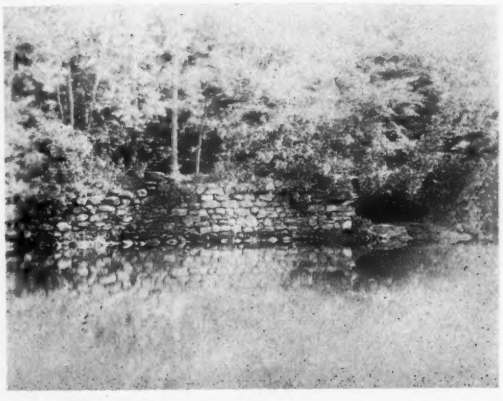
The Croton River is a placid little stream of water, but a mile long, which now extends from the enbankment of the tracks of the N. Y. C. H. R. R. to the foot of the great Cornell Dam. The Cornell Dam impounds the waters of Croton Lake, the southernmost reservoir of the New York watershed lakes to the westward.

During 1818, Bailey Bros. established a wire drawing industry along the east bank of the Croton River. The Croton was then of considerable size and navigable for canal boats and large barges for a mile from its mouth, where it flowed through a draw-bridge at the railroad embankment and became confluent with the Hudson River. Some of the older inhabitants of the vicinity remember when the "Leader", a steamer belonging to Jenk's brothers, which plied between Ossining and New York City, often made a special trip up the Croton River for a shipment of wire for New York.



The wildest imagination could not conceive of this having once been the location of a smelter.

In 1842 the first Croton Dam was completed and shortly after, the water that was employed to turn the wheels of the wire mill, was diverted into the Croton Aqueduct and thereafter, the source of power for the wire mill became an unstable commodity. However, the supply of water above the dam was so great that only during extremely dry summers was the flow over the dam interupted. This spill, augmented by the waters from Hunter Brook, a sizable stream flowing into the bed of the Croton River a mile or so below the dam, furnished ample water for Bailey's mill race, so the wheels were kept turning. During the early 50's Bailey Bros. were succeeded by Johnson, Gilmore & Sergeant, who soon found that the waters



Site of the old wire mill, showing the outlet of the mill race. It was built more than 100 years ago.

of the Croton were becoming shoal in places and that navigation, excepting during extremely high tides, was impossible.

They then began to transport their wire by wagons, over the Old New York Post Road, to Croton-on-Hudson. Native iron ore was smelted and treated in a blast furnace that was located a half mile above the wire mill, near the site of Quaker Bridge. Doubtless much of this malleablized iron was used in the wire mill, but there are no records obtainable that substantiate this fact. Only the wildest imagination could conceive of a smelter having been located upon the spot shown in the accompanying cut, yet such was the case.

The writer, as a boy, forty years ago, camped on Paradise Island, a half mile below the former site of the wire mill and he can remember the dismantled wire mill, with roof fallen in and trees taking root within the foundation. Now, nothing remains of the mill saving the wall along the river bank and the outlet of the mill-race, shown in the cut. The remarkable part of this is the fact, that though a hundred years old, this brick arch is practically intact to this day. Directly opposite, firmly fastened to the precipitous granite cliff, is a stout iron ring, that once held vessels waiting to load or discharge cargoes at the wire mill.

While navigation of the Croton River had practically ceased by 1863, the railroad could not officially recognize this fact without an act of Legislature, so the draw bridge tender remained there on duty, year after year, ready to open the draw for any boat demanding entry.

When the Civil War started, Johnson, Gilmore & Sargeant decided to quit drawing wire and sold out to Jas. Montgomery, who attempted for awhile to continue the business. Montgomery was a canny Scot. Knowing that the draw-bridge was rusted fast, he built a scow, on which he loaded some machinery from the wire mill and one morning, taking advantage of an unusually high tide, poled the scow-load of machinery down to the draw and demanded that it be opened. Old Phil, while knowing that the draw would not budge, attempted to open it, then sent for a section gang. The railroad employees worked night and day for three days, while Montgomery waited inside, living on his scow. Finding that it was useless to attempt to move the draw, an official of the New York Central came up and interviewed Montgomery. After some dickering, the old Scotchman agreed to abandon the scow and cargo for the sum of Ten Thousand dollars. He received a check for this amount and the following January, an act was passed by the Legislature at Albany, declaring that the navigation of the Croton River as well as the career of the wire industry on the river, was ended.

World's Finest Wire Cloth

Newark company makes wire cloth having 160,000 openings per inch.

A WORLD'S record has been established by the Newark Wire Cloth Company, Newark, N. J., by making a wire cloth having 160,000 square openings per square inch. It is the finest wire cloth ever made.

In other words, it is a "400 mesh" wire cloth with 400 parallel wires per inch of width running each way, at right angles.

400×400=160,000 openings.
1,000,000 divided by
160,000=6.25

Therefore in a piece of the wire cloth slightly more than 6 square inches in area, there are *one million holes*. Or, to be exact, in a piece only 2½" square there are one million *square* microscopic openings.

Heretofore the finest wire cloth ever made in the United States has been 325 mesh and it, too, is made by the Newark Wire Cloth Company. It is known as Sieve Number 325 by the U. S. Bureau of Standards, and has been adopted as standard by the American Society of Testing Materials.

Those unfamiliar with fine wire cloth and its manufacture probably cannot appreciate the difficulties encountered in making a 400 mesh cloth. 325 mesh is fine, yes, but 400 mesh is so much finer that each square inch of 400 mesh contains 54,375 MORE OPENINGS PER SQUARE INCH than the 325 mesh cloth.

To be sure ordinary fine wire is not fine enough for 400 mesh wire cloth. It hasn't the necessary quality—the correct temper—the required uniformity. The Newark Wire Cloth Company, for many years, has found it necessary to draw all of its own fine wire, and of course it was an absolute requisite for them to draw the wire for this 400 mesh cloth themselves.

Some ten years ago the United States Bureau of Standards in their investigation of testing screens, said that it seemed impossible for American manufacturers to successfully manufacture wire cloth with meshes finer than 100 to the inch, and that wire cloth with finer meshes had to be imported. For a long time previous to this, all of the fine wire cloth on sale in the United States came from foreign countries. At that time 325 mesh was the finest made, and 250 mesh was the finest produced in the United States.

It is a fact that the manufacturers of the United States had been rather backward in the fabricating of wire cloths finer than 100 meshes to the inch until about 1912, when some experimental work was started in weaving a piece of 200-mesh cloth of a special metal for a

(*Please turn to page 105*)

Brazil's Barbed Wire Imports

By A. C. Blackall

ALTHOUGH the Brazilian import market is at present in a depressed state and competition in supplying its large requirements of barbed wire is severe, this branch of trade is in the opinion of commercial experts well worth investigation. British Trade Commissioners in Rio de Janeiro have recently been calling attention to the growing consumption of this article in Brazil.

Barbed wire imports of late years have varied from 20,000 to 50,000 tons annually, and during the first six months of 1927 the United States alone was responsible for supplying nearly 700 tons. Germany has recently been the most important supplier, owing to the low prices quoted. However, there is not a proportionate demand for fencing rods or supports. There are two reasons for this. Firstly, iron rusts very quickly in the country, and, secondly, suitable timber for making posts is nearly always plentiful and handy.

With the greatly increased immigration of settlers on the land it is anticipated that the consumption of barbed wire will continue to grow. Large tracts of land are being subdivided into small holdings, and on these as well as on the large farms great quantities of wire are used. The types mostly in demand are:—

"Iowa" Type.

Size No.	Net Weight.
12½	37 kilos
12½	35 kilos
14	27 kilos and 60 lbs.

"Glidden" Type.

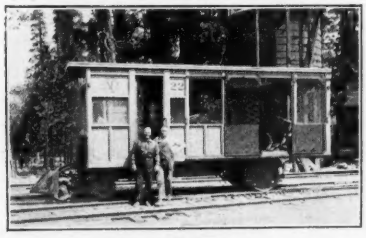
Size No.	Net Weight.
12½	37 kilos
12½	35 kilos
14	60 lbs.

Size No. 13½ in both types is sold principally in the Sao Paulo market. The barb for both types should consist of four points at intervals of three inches. In the case of the "Iowa" wire this barb is interlocked between and around both main strands, and in the "Glidden" type it is wound around one strand only. The weight of the rolls given above is understood to be the bare weight of the wire, 2 kilos usually being the weight of the spool. These spools are always unpainted double wood crosspieces, well-shaped and of strong construction.

German and Belgian wire manufacturers were recently quoting prices ranging from $66.25 to $75 for sizes No. 12½, and $70 to $73.75 for No. 14 in both types, c. i. f. Rio de Janeiro, per 1,000 kilos. Quotations are usually asked for c. i. f. Rio de Janeiro per 1,000 kilos, or in lots of 1,000 or more rolls. A few importers, mostly in Sao Paulo, insist on knowing the exact length of wire on each roll. Quotations are frequently required on 1,000 to 8,000 rolls, and in Sao Paulo on as much as 20,000 rolls on occasions.

There is also a good demand for staples for use in fixing barbed wire to the wooden posts used in Brazil. These are generally No. 9 gauge of 1 in. and 1¼ in., and are usually packed in kegs of 50 kilos or 100 lbs. net. Recent Belgian quotations on staples vary between $65 and $72.50 per 1,000 kilos, while German prices are a little higher.

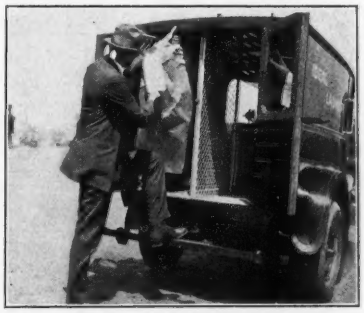
Motor Truck Mounted on Flanged Wheels Has Compartments Surrounded By Heavy Wire Work



A very interesting truck is used by the City of San Francisco for hauling mail and baggage over the Hetch Hetchy Railroad. This truck is equipped with six steel flanged wheels which adapt the equipment for operation over the steel rails of the railroad which is owned and operated by the City of San Francisco in hauling construction material for the Hetch Hetchy Power and Water Project.

The rear compartment is equipped with two side doors which are built entirely of heavy wire screen and are designed to slide back and forth on overhead rollers to close the opening. Two other panels are equipped with the same material.

Compartments In Laundry Waggon Specially Designed For Carrying Garments To Be Dry Cleaned Are Built Of Heavy Wire Screen



THE accompanying photo shows a wire screen cage installed in the rear of one of the laundry trucks operated by the Ideal Laundry which firm also maintains a dry cleaning establishment in connection with their laundry, in San Francisco.

The drivers of certain of the laundry trucks also handle garments to be dry cleaned. For the purpose of protecting these garments from theft and to provide a place for carrying them so that they will not become soiled, they are carried in the wire screen compartments which are kept under lock and key, and only the driver of the truck carries the key. At the top of the compartment there is provision for hanging the clothes hanger. The door to the compartment is at the rear enabling the truck driver to gain quick and easy access to the garments carried.

British Wire

Inspection of rod-galvanizing and Richard Johnson

By Jos. P. Bedson

THE making of wire is one of the most ancient arts, and evidence of its existence is quoted from documents dated from 1700 B. C. Some specimens now existing are known to have been made about 800 B. C., so that it is probably not too much to claim that the making of wire was amongst the first discoveries of the early metallurgists. The earliest wire made by the use of the draw-plate was no doubt pulled through the die by main force, the worker straddling backwards along the draw bench. The following stage was the use of a form of hand-operated machine by which the operator was able to exercise a considerable leverage in pulling the wire through the draw-plate. Iron wire was being made in England about the middle of the sixteenth century. In the early days the best iron was selected for wire-making, and the bars were prepared for drawing by being hammered into rods. The coarse drawing on the "ripping" or "rumpling" benches reduced the diameter to enable it to be drawn down through ever smaller dies until the required size was obtained. By Cort's invention of grooved rolls in 1783 rolled rods were made available, but even in 1830 the rods were not much longer than the old hammered article, being about ⅜ in, dia, and 10 ft. long.

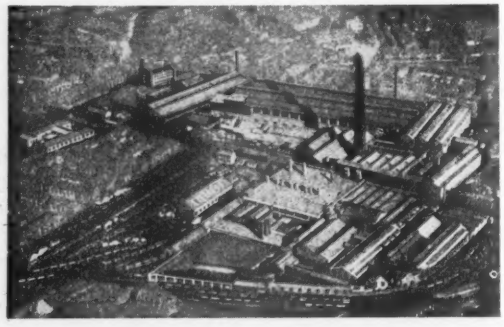


Fig. 1—Aerial view of wire works lay-out.

Th wire-drawing industry expanded enormously when the need for more abundant supplies arose in 1847 for the electric telegraph, and in 1859 for the crinoline, and great improvements in production resulted. Mild steel almost entirely superseded the wrought iron, and enabled much larger billets to be rolled, so that when the set-back in 1870, due to the passing of the crinoline fashion, threatened production, new demands arose for fencing wire, baling wire, nail wire and rope wire, which requirements are the back-bone of the wire trade at the present day. From the old 28-lb. billet to the 100-lb. size was a big jump, but it soon was exceeded by the 150- to 170-lbs. size, and now it is quite common to utilise 2-in, sq. billets 28 to 30 ft. long, and weighing over 350 lbs. To produce the rods, the billets are heated in a suitable furnace to the required rolling temperature, and then passed through a train of rolls, which may either be arranged in the looping fashion of the Belgian mill, or in the more modern continuous train introduced by Mr. George Bedson in 1862, and further developed by Mr. C. H. Morgan in America, with certain improvements which he had discussed with the originator when he visited him in 1878.

As a practical example of carrying out the various manufacturing operations, it is proposed to follow the somewhat unique methods in use at the Bradford Iron Works of Messrs. Richard Johnson & Nephew, Limited, in Manchester. It is remarkable that despite present-day tendencies to huge trading amalgamations, this firm, of over 150 years' standing, has retained its strongly inherent individuality, at the same time maintaining its place in the front rank of the wire trade. No firm in this country can more justly claim to be the cradle, nursery, school and feeder of this important industry, and it is no stretch of the imagination to say that it acted as god-father to the similar industry in the United States of America. The modest output of 40 tons per week of wire for domestic and industrial requirements in 1830 was rapidly augmented to meet the demands of the telegraph industry and the increasing number of suspension bridges, so that by 1860 the output was 200 tons per week. From being buyers of their raw material as rods, about 1854 they became interested in the Bradford Iron Works, where 20 puddling furnaces were at work with metal helves, forge and merchant mills, to which two rod-mills were added.

Subsequently the whole plant and offices were removed from Ancoats to the Bradford district, and with the passing of the iron-wire trade on the introduction of the Bessemer and more particularly of the basic-Bessemer process in the early eighties, great improvements were made, such as the Bedson system of continuous rolling of rods (1862), and continuous method of galvanising wire (1860), which enabled long lengths to be produced, and almost monopolised the telegraph-

*Reprinted from Iron and Coal Trades Review

Drawing Works

rolling, cleaning, patenting, wire drawing plants of & Nephew, Ltd. *

and J. S. G. Primrose

wire trade. A great departure in 1874 was the acquiring of ironworks at Ambergate, on the Derwent, near Derby, where special kinds of wire were drawn from rods into fine sizes, and the higher qualities for ropes, tinning, coppering, galvanising and bright—all by the use of water power. A copper-wire department was established in 1904, and has grown progressively at Bradford, so that billets can be rolled and the resulting rods drawn to different wire and bar sections for all sorts of electrical and engineering requirements.

Works Lay-out.

From the aerial view (Fig. 1) it will be seen that the works are compactly arranged, and although the plant has been frequently rearranged, there is still a continuous route of successive operations. From Beswick railway goods-yard most of the steel billets arrive and are unloaded by steam travelling crane for one rolling mill, and by electric-magnet overhead travelling crane for the other. Coal arrives partly in the same way, and also from the adjoining colliery. Cleaning-house acid arrives by boat from adjacent factories situated on the canal which bounds the works on the north, and a branch of which separates the two rolling mills. Much of the sea-borne copper-ingot bars arrive from the docks by motor lorry, and leave again after manufacture by the same way. From the rolling mills the rods are passed by a conveyor to the warehouse floor, where the coils are weighted and stacked ready for passage either through the tubing furnaces for "patenting," or direct to the acid cleaning house. After washing the cleaned coils, they are passed through the "bluing" ovens to remove brittleness, and, having been suitably "coated," they are next drawn in the wire-mill to the desired size, with sometimes an intermediate annealing to attain the finer-gauze sizes.

Plain wire is now ready for despatch, but considerable quantities are passed on to the galvanising department, where continuous operation enables large outputs to be achieved. A small proportion of this coated wire is spun into wire rope, and some is used for making various forms of barbed wire. Loading bays serve the various stores for removing the completed article with the minimum amount of handling. The chief product is thus steel rods of all carbon contents from 0.05 to 0.75 per cent. in various sizes, only a small portion of the output being drawn to wire and galvanised, the same being true of copper, of which only a part is reduced from the rod to the wire form, some of which is tinned.

Continuous Rod Mills.

Two looping mills were replaced in the Bradford Ironworks by the No. 1 Bedson continuous rod mill, which ran till 1884. It comprised a series of sixteen pairs of rolls arranged close behind one another in alternate horizontal and vertical housings. This gave the billet and strip the requisite deformation, first in one plane and then in the other at right-angles to it. The output was about 20 tons of No. 5-gauge rods per shift of 10 hrs., dealing with 1⅛-in. sq. billets, 18 ft. long, and weighing 75 lbs. In 1866 the second continuous mill was put down, to roll puddled iron, and it is still running on anything up to 0.75 per cent. carbon steels with an output of 400 tons per week, on 7½-hr. shifts. It is driven by spur and bevel gearing from a remarkable old steam engine, and the roll train has been split up so that there is a loop at the eighth and twelfth passes, which is a great advantage. It suffers from the drawback of having the gearing for the vertical rolls placed below floor level, and thus mill scale and dirt fall upon them, with consequent increased frictional losses. Other mills have been put down since 1866, one of which, in 1868, was shipped to America as the pioneer continuous rolling mill there.

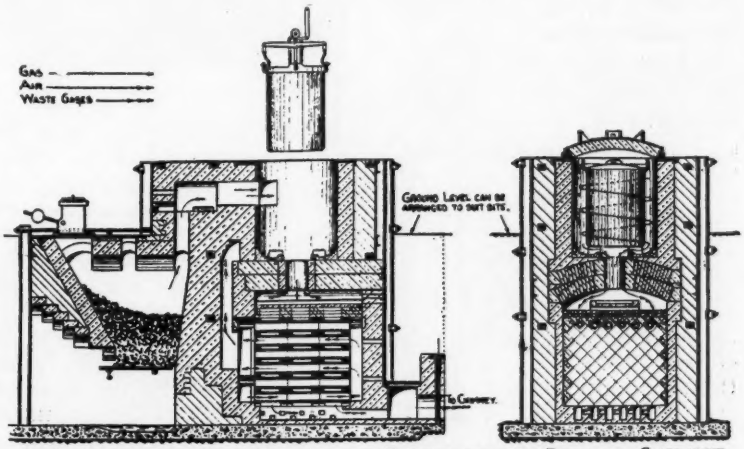


Fig. 3.—Sections of the Rotary Flame Annealing Furnace showing the Path of the Gases about the Pot.

A modification by Mr. Turnbull in 1896 was to place the gearing for the vertical rolls overhead, but this mill no longer exists. The greatest advance was made in 1916 when the latest No. 5 mill was constructed to the designs of Mr. J. P. Bedson. It follows the Morgan principle of having all the rolls placed horizontally, but is unique in having them all positively driven by double helical-toothed gearing coupled direct to a powerful electric motor. After running almost continuously since 1918, a recent inspection showed that the gearing had suffered no deterioration. Its running output is 120 tons of 2-in, billets, 28 ft. long, and 364 lbs. in weight, reduced from 2 in- sq. to No. 4 or 5-gauge rods per shift of 7½ hrs. The mode of operation, which only requires five men, consists in feeding the billets from the bank where they are deposited by the magnet crane, by live rollers, which place them at the back of a single-span-roof furnace. Here the billets (to the number of 60) are pushed down the sloping hearth by hydraulic rams until they reach the outlet doors, by which time they are at a temperature of nearly 1,000 deg. C., to which they are raised by the combustion of steam-enriched producer gas supplied by two adjacent automatic Morgan water-bottom producers.

On a given signal from the starter, a bar driven forward between a fixed and a movable live roller pushes a billet into No. 1 or No. 2 entering guide for the rolls of the roughing train, so that two billets can be passing simultaneously through the nine pairs of horizontal rolls before emerging to the conveyor pipes, sometimes flooded with water as are the rolls themselves. On emerging from the end of these, a catcher seizes the end with short tongs, shears off the forked end, and enters the strip into the first rolls of the finishing train, consisting of seven pairs of rolls running at progressively higher speeds up to 900 r.p.m. The rod is thus turned back towards the furnace end, forming a loop which extends down the iron-floored slope (Fig. 2), and is there usually tended by a lad to prevent it tangling. The finished rod is delivered from the last rolls to one of three coilers attached to each of the two separate finishing trains, and when the coil is complete it is hydraulically tilted off on to a conveyor, on which it gradually cools on the way to the warehouse floor, there to be examined for shape or surface and then stacked after weighing. As the rolls are all 12 in. dia., the finishing set runs out the rod at well over 30 miles per hr., and in the event of a break-out considerable damage might be caused if the finishing trains were not completely caged in. When the rod is obstructed and forms a "gob," the red-hot metal swells into a large section of metal which is welded together without a flaw being observable even under the microscope.

Cleaning and Bluing

After classification and storage of the rolled rods in a suitably large warehouse, the first step in wire-making consists in

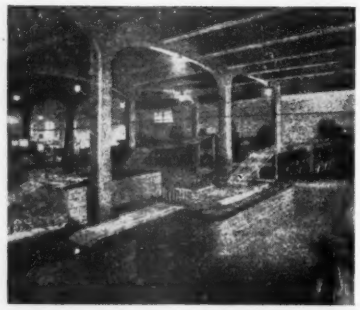


Fig. 4—Continuous Galvanizing Baths and Electrically Driven Winding Frames.

perfectly cleaning the rods as produced by the mill. Old-fashioned methods of scale removal by beating, etc., were slow, and are now speeded up and made more effective by immersing the coils in acid, which may be either sulphuric or hydrochloric acid, of suitable strength, the latter acid being generally preferred in cases of heavy scaling. The commercial acid is preferably reduced in strength to suit circumstances,

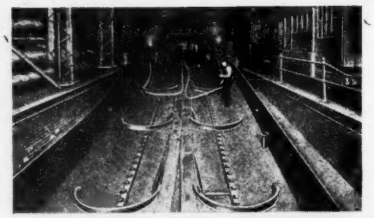


Fig. 2—Looping Ovals into the Finishing Trains of the Continuous Rod Mill.

so as to prevent excessive wasttage of metallic iron, and this may be further effected by the addition of small amounts of some restrainer of the colloidal type, which materially reduces this source of invisible loss. Immersion in the acid contained in stone tanks should not exceed 20 to 30 min. in normal cases, after which each batch is washed thoroughly with water and "coated." This process of coating causes a thin covering of brown iron hydrate to form by exposure of the moist metal to the distinctly acid atmosphere of the cleaning house, after which the rod coils may be given a simple dip in a heated bath of slaked lime to prevent rusting and improve the coating, and then the batch is transferred to the next stage of "baking."

Bluing is another name for the low-temperature baking which it is advisable to give to all coils of either rod or wire which have been cleaned in acid, as this is the only safe method of removing the treacherous form of brittleness imparted by the hydrogen gas left occluded in the metal by the cleaning process. Good ventilation arrangements in the stove are needed to ensure complete removal of the excess moisture from the coils of rod, and the moderate temperature of 400 deg. Fah. is quite sufficient to render the steel amenable to the drawing treatment after only a few hours, varying with the section being treated.

Annealing

This may be used for two main purposes:—(a) To soften partially-drawn wire sufficiently to enable further drawing to be done without fracturing it; this comes intermediately between two suitable stages of the re-

duction, and is of advantage in enabling special sections to be produced in which the corners are difficult to fill up completely. (b) To soften completely finished wire (and sometimes uncleaned rods) to enable severe cold-work to be imparted to them in subsequent manufacturing operations in which there is need for grain-refined material. Obviously the first operation can be done very much more quickly and simply than the second, and although both are commonly done in some form of closed pot, it is quite feasible to do the heating with the open coils laid on the hearth of a gas-fired furnace, taking 2 to 4 hrs. at between 650 deg. to 700 deg. C., depending on the gauge and quality of material, which is afterwards cooled off in soaking pits, thus preventing too sudden a fall in temperature. A continuous method formerly used in America consisted of passing anything up to 30 lines of wire through a 15-ft. bath of molten lead kept at about 600 to 700 deg. C. by oil burners, the time of immersion depending on the gauge of the wire and the degree of softening desired. The serious difficulties of heavy repairs and renewals, as well as the larger labour costs, have militated against its general adoption.

The old form of pot-annealing process employed an upright cylindrical stove with fire-brick lining set with the top at floor level, and a coal-fired furnace near the bottom level. The coils of wire or rod were stacked around a central iron pipe, down which the products of combustion passed after encircling the pot. Double lids sealed off the annular space in which the wire was packed and the fire had to be drawn and the whole charge allowed to cool down sufficiently before the hot task of unloading was attempted. Time and labour costs are both serious items in this method, which is now considerably speeded up by the more modern system of having separate annealing pots loaded up and sealed with a cover plate quite outside the furnace. Usually this producer-gas fired vertical oven (Fig. 3) is provided with two cells in one massive, and the air, which is preheated from recuperators, enters near the gas port at the top of the circular furnace, and after sweeping the flame several times round the pot, the products of combustion leave by a central outlet below the bottom of the pot, which is supported above the bottom of the furnace on stools. In continuous working conditions, the cold pot thus enters an already heated chamber, and with the gas on, the temperature rises rapidly; and after the requisite heating time has been allowed, a short soaking at the maximum temperature follows. The cooling is then effected by transferring the pot to a separate brick-lined chamber, of which a series is arranged round the furnace, and the next pit is charged into the furnace without loss of time or heat, as would be the case in the older method, in which the furnace and pot had to be cooled down to allow of work to be done in unloading.

An article on
The Manufacture of Tinsel
By Harrison B. Williams
will appear in
the next issue of
Wire & Wire Products

Instead of producer gas it is sometimes feasible to use town gas, as in certain plants in America, where the introduction of the surface combustion method of heating has revived the open-hearth method of annealing. In this way the coils of wire or rods are passed into the heating chamber, which may have a solid bottom measuring about 10 ft. by 12 ft., and, using approximately 800 cub. ft. of 525 B. T. U. gas per hr., can deal with charges up to 30 cwts. every two or three hours, depending upon the nature of the material to be treated. No flues are needed, and the very perfect combustion can be so easily regulated from the six-a-side burners that scaling, which was excessive in older forms of this type, can be kept down to less than 1 per cent. On withdrawing the coils from the furnace they are dropped into the cooling pits in the floor, and covered over with lids to ensure slow cooling and no further scale formation. In both types of furnace the need for pyrometer control is now almost universally acknowledged, and in many cases carried out successfully when the knowledge has been derived connecting external readings with internal conditions in the pots, there being almost no allowance needed in the open hearth.

Patenting

This is a process of heat-treatment applied to rod or wire whereby the structure of the metal is put into such a condition that it is able to be drawn to a much finer wire and attain a much higher tensile strength than would be possible without this process. The effect produced—due to the steady rise in temperature to well above the critical point of the steel involved, a steady maintenance at this temperature for the necessary time for the size being

(*Please turn to page 94*)

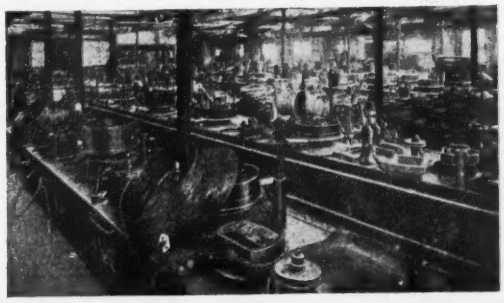


Fig. 5—Wire drawing benches for single hole operation.

Sleeper & Hartley TRADE MARK
REG. U.S. PAT. OFF. & PRINCIPAL FOREIGN COUNTRIES

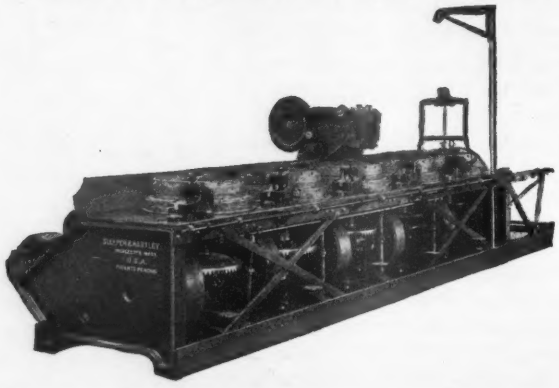
Practical Continuous Wire

These Machines Go Into Production at once—

Rod Frame

(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending

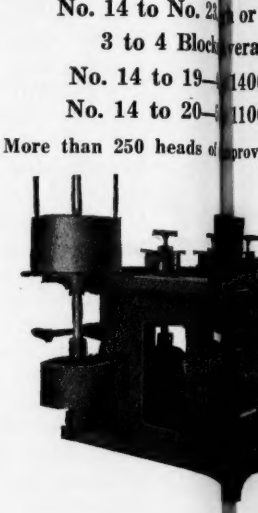
All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.



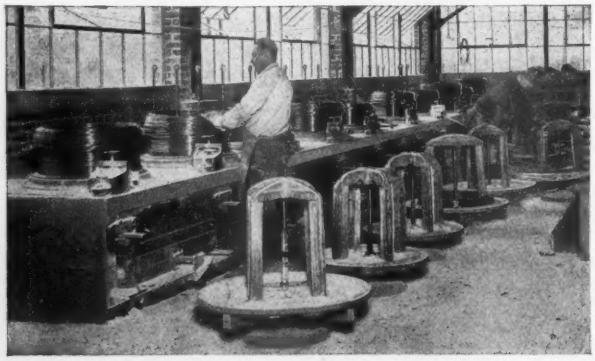
Double 5-Drafry,

No. 14 to No. 23 or
3 to 4 Blocks vera
No. 14 to 19—140
No. 14 to 20—110

More than 250 heads of improv

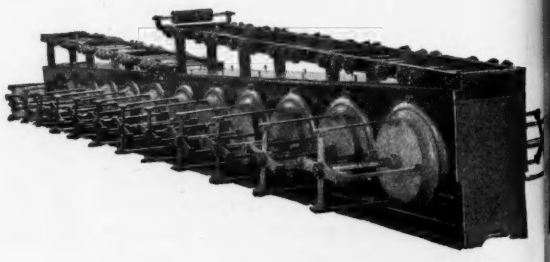


IMPROVED WIRE MILL EQUIPMENT



Standard Rod Frame—10 Block

Long, Stiff Spindles, in anti-friction bearings, and equipped with friction Clutches. Powerful and reliable.
Practically noiseless in operation.
(New Plant of Thompson Wire Co., Worcester, Mass.)



Patenting Furnace Take-Up

(New Plant of Thompson Wire Co., Worcester, Mass.)

AGENTS: CHICAGO TERRITORY,
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SLEEPER & A

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19– 1400 lbs. per block.
20– 1100 lbs. per block.
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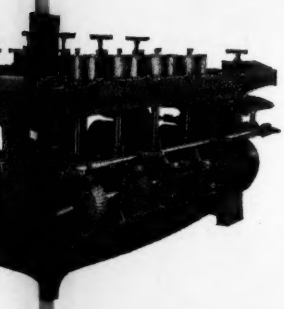
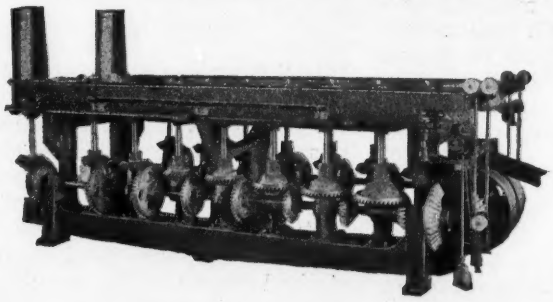


Double 8-Draft Fine Wire: Wet

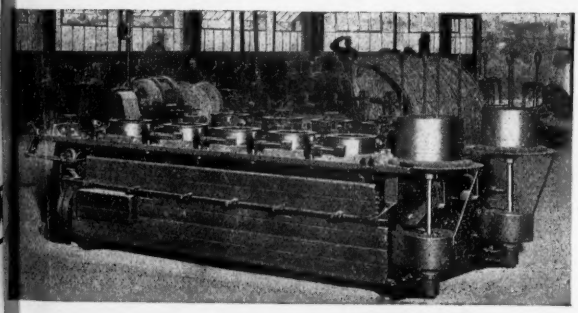
No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousands of these heads in operation

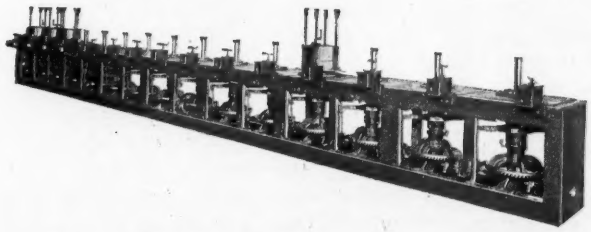


QUIPMENT RECENTLY INSTALLED



Double Six—Draft Dry Continuous For High Carbon Wire

Direct driven with silent chain. Cut gears throughout. Anti-friction bearings. Variable speed for finishing block.
(New Plant of Thompson Wire Co., Worcester, Mass.)



Heavy 16" Frame For .65 Carbon Wire No. 10½ to .037"

15 Blocks: Motor driven. Silent chain. Anti-friction bearings and cut gears throughout.
(New Plant of Johnson Steel & Wire Co., Worcester, Mass.)

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Agents: Philadelphia Territory
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STE ASS., U. S. A.

NEWS OF THE INDUSTRY

American Pin Co. Announces Dissolution.

THE American Pin Co., subsidiary of the Scovill Mfg. Co., is to terminate its corporate existence through dissolution. Notice is given that the stockholders have voted such dissolution, which will become effective within four months of the notice. All claims against the corporation must be presented within said four months from Jan. 25, 1928 to Bennet Bronson of the Scovill Mfg. Co. The company will continue to be known, for purposes of identification among company officials and employes only, as the American Pin division of the Scovill Mfg. Co.

The pin industry was founded in Waterbury. It originally began here as a branch of the Benedict & Burnham Mfg. Co., and became a distinct organization in 1846 as the American Pin Co.

The American Pin Co.'s factory now stands in Waterville but it originally was located on the Moriarty property on East Main street where the old Poli theatre rests.

The invention by Chauncey O. Crosby of a machine for sticking pins on paper led to the formation in 1852 of the Oakville Co. The contest over the Crosby patent which was claimed to be an infringement of the American Pin Co.'s "goose neck" patent device for sticking pins, was the foundation of the Oakville Co.'s success. In this the courts upheld the Oakville Co. After this controversy, the two companies developed along thoroughly harmonious lines.

The American Pin Co., was incorporated in November, 1846. Pape's history of Waterbury says: "The American Pin Co., was organized with a capital stock of $50,000. It was a feeder for the wire mills. The company moved to Waterville in 1894 to acquire more room. In 1890 the company was doing a business of about $150,000 a year and in 1918 the business of the corporation amounted to $3,000,000 a year." Since then business had fluctuated some.

American Steel and Wire Co. Plan New Plant

THE American Steel and Wire company, a subsidiary of the United States Steel Corporation, plans to spend $5,000,000 on improvements during 1928. Construction of a new rod mill costing approximately $3,000,000 is planned and the balance of the budget is to be spent on existing mills and various other plants of the company. Operations of the company are reported at almost 60 per cent of capacity, or even with the general level of the United States Steel corporation operations throughout the country.

Chicago Firm New Office

THE southern branch office of the Gerard Company, Inc., of Chicago will be moved from Atlanta to New Orleans, according to an announcement of the Association of Commerce Thursday. The Gerard Company manufactures wire tying machinery and wire for strapping cases and bundles of merchandise.

Walker Ross, Jr., secretary of the publicity bureau of the association said, the plant is being moved to New Orleans on account of the low freight rates offered by the Mississippi river and the better facilities offered in New Orleans for serving the South. The New Orleans plant will serve twelve southern states, from Texas to Virginia.

B. H. Bond, of Atlanta, will be transferred to New Orleans as manager of the plant here.

$3,003,205 Paid in 1927 by Steel to Retire Force

Average Monthly Pension $51.45 With Beneficiaries Making No Contribution

RETIRED employes of the United States Steel corporation and subsidiaries received $3,003,205 in pensions during 1927, it was shown today in the 17th annual report of the United States Steel and Carnegie pension fund. The payments brought to $18,836,934 the total of pensions paid since the fund was inaugurated in 1911.

The average age of 1,175 employes retired during 1927 was shown to be about 63 years. The average period of service was nearly 33 years and the average monthly pension was $51.45.

Carnegie Steel company was first among the subsidiaries in amounts paid, its total being $783,896. American Steel & Wire Pension disbursements totalled $610,062. American Sheet & Tin Plate, $401,675; National Tube company, $283,019 and other subsidiaries expended smaller amounts.

Beneficiaries make no contributions to the fund, income of which is derived from a fund created jointly by the late Andrew Carnegie and the United States Steel corporation, it was explained. The corporation provides needed additional money for administration.

Philadelphia Insulated Wire

PHILADELPHIA Insulated Wire Company has issued its balance sheet as of December 31, 1927. It indicates earnings for the year of $118,455, equal to $4.73 a share on the capital stock, compared with $165,688, or $6.62 a share in the previous year.

British Let Contract For Big Colliery Wire Ropeway

AN important contract has been entered into between the Tilmanstone Colliery Co., Ltd., and Ropeways, Ltd., the new British rope combine, for the construction of the much-discussed overhead wire ropeway between the colliery and Dover Harbor, nearly seven miles away. Tilmanstone is the oldest-established pit of the East Kent group, and geographically it occupies one point of a triangle, of which Deal and Dover are the other points.

The aerial ropeway will be supported on standards of steel or reinforced concrete at intervals of 120 yards, and each container will travel from colliery to harbor with a load of 1,568 lbs. This overhead haulage system will be electrically controlled, and will have a working capacity of approximately 135 tons per hour. It will be dustproof, and for the protection of the public wire netting will be placed over all roads, sidewalks, and railway lines at points where they are crossed by the new line of coal transit.

Parker Wire Goods Co. Expands.

THE Parker Wire Goods Co. has bought the plant and business of the Stephen Richard Co., Inc., of Southbridge, manufacturers of cutlery since 1861. Manufacturing will be continued in Southbridge, but the sales end will be conducted from this city. The business was founded by Stephen Richard at Bridgeville and moved later to Southbridge. The business was sold by the Richard family in 1917 and incorporated.

About $200,000 For New Wire Machinery

OF the $5,000,000 to be spent in plant improvmeents by the American Steel & Wire Co., in 1928, about $200,000 will be spent in Worcester.

According to Clinton S. Marshall district manager, this sum will be expended, practically in its entirety, for the replacement of obsolete or worn-out machinery.

The company will spend $3,000,000 at the Cuyahoga works in Ohio, where a new rod mill will be erected.

Present operations are said to be at about 80 per cent of capacity.

Copper Purchase

WIRE drawing interests entered the market for Copper rather unexpectedly and purchased about 5,000,000 pounds on the basis of $14.25 a pound, delivered in Connecticut, Engineering & Mining Journal reports.

The Silent Caddy

THIS "SILENT CADDY" Enables each golf player to become his own caddy. The device consists of a wire arrangement that can be attached to any golf bag and holds the bag in an upright position so that it is easy and convenient for a player to obtain the club desired. It will stand upright on any golf course and is a bag and back saver, being specially adaptable for damp mornings, as it keeps the bag off the grass. There is also a holder for carrying a lighted cigarette while the player is making a shot.

The device is the invention of Mr. F. A. Hollian 231 Geary St. San Francisco.

Digest of Current Literature on Wire.

Safety Forces Discarding of Wire Rope

When to Discard Wire Rope, by C. D. Meals, rope engineer, Amer. Cable Co., in Western Machinery World, Jan. 1928, pp. 22-23.

MANUFACTURERS are interested in the frequency of discard of wire rope because each such discard forms a new sales opportunity. This author lays considerable stress upon safety and uninterrupted operation as the governing factors in rope discard. He places considerable emphasis too, upon the proper selection of the size, type and quality of the rope for the duty. While he states that no definite rules can be applied since "too much depends on local application and the degree of maintenance-attention during service" he still points out broad rules in a few industries. For service with shop cranes, electric or pneumatic hoists, wire rope should be discarded when there are four or more broken wires in any one strand, when outer wires have been worn off one-third or when loss of area exceeds 15 per cent through breakage and wear. Shaft or skip hoist ropes should be discarded when more than three adjacent wires are broken in any one strand, when outer wires are worn off one-third or when corrosion appears. In addition, the U. S. Bureau of Mines advocates that ropes shall not be used after three years in service, even if idle, unless tested for ultimate breakage. Derrick ropes or fall or hoisting lines should be discarded when six or more adjacent wires are broken in any one strand or when outer wires have been worn to one-half their original diameter.

Before discarding rope, consider the type, because preformed cables give longer service

than ordinary. Where life or limb would not be endangered, rope can be used longer, even up to the breakage of an entire strand. This in such service as car hauls, car transfers, spotters, hot beds in steel mills, etc.

New Methods in Wire Galvanizing

Wire Galvanization Methods Discussed, by C. F. Poppleton, consulting engineer, Pittsburgh, in Blast Furnace and Steel Plant, Dec. 1926, pp. 529-33.

WIRE is second in importance as a galvanized product, so is worth serious consideration by wire men, galvanizers and others. In this process, the first step is to clean thoroughly by pickling in acid, using sulphuric acid 4-10 per cent by weight, 7½% at 150 deg. Fahr., being a fair average, heated by live steam. The sketch of the apparatus used (see also Feb. issue, p. 58) shows the first bath to be in a wooden vat containing 10% sulphuric acid, the second muriatic acid 5 per cent, and the third water. It is then dried over an oven, then galvanized, then reeled. By making the first acid vat 6 ft. long, the second and third each 4 ft., the oven 6 ft. and the galvanizing tank 12 ft., the entire apparatus occupies but 38x6 ft. of floor space.

After the pickling operation, the material is given a bath of molten spelter through a flux. The latter gives the final cleaning and removes any oxide formed after pickling. A good flux consists of 4 lbs. of gray granulated sal ammoniac, 2 oz. glycerine and 2 oz. tallow. The molten spelter is divided longitudinally by a flux guard, consisting of an angle and a sheet of 16 ga. steel attached to this and extending 3 in. below the surface. The front of this flux box is filled with very heavy flux and is kept fresh by dipping out the spent and speading this on the center portion, constantly. Another such box at the exit of the wire is filled with coke dust 4 in. deep sprinkled by a stream of water. The wire must remain in the spelter long enough so its temperature is raised to that of the spelter; if not it will be unevenly coated. If too cool there will be heavy coating in spots, none in others. If in the spelter too long, the output will be reduced. This means varying the speed to suit the wire size and other conditions, so the reel is both demountable and adjustable to permit speed variations. An asbestos brush cleans and two dies drive the spelter into the steel, reduce its thickness and give greater adhesion, these being located at the reel.

British Wire Drawing Works

(*Continued from page 89*)

to a large size, and finally maintain the maximum amount of sorbite within these large grains. To bring this about, the coils of rod or wire are threaded individually, or by twos, through a series of channels called "quarries" forming a muffle the whole length of the heating furnace. This may vary from 25 to 50 ft. long, and can accommodate from 15 to 30 separate lengths. The firing was originally by means of three separate fire-places, back, front and middle, but this was later converted to producer-gas firing, with suitable flue passages and air recuperators to remove as much of the heat from the waste gases as possible before their escape to the stack providing the draft. The recent scarcity of available coal supplies led to the introduction of oil-burner methods of heating, and waste-heat recovery enables enough steam to be raised to operate the power production needed.

The emerging wires are coiled after partial cooling in the air, which is sufficiently rapid for most of the medium- and high-carbon steels usually treated in this way and variable speeds can be imparted to the driving mechanism in order to suit the speeds required for different sizes, and also to compensate for the larger diameter of coils formed on the blocks near the end of the length of wire. To save excessive scaling, it is sometimes considered necessary to seal the heating channels, but by providing a slight excess pressure in the combustion chamber, a small leakage of gas enters the channels, thus providing a reducing atmosphere, and instead of about 5 per cent. oxidising loss, the scale can be kept well below 1 per cent., with corresponding saving in the subsequent cleaning before the drawing operation.

Instead of the separate channels, it is possible to make the muffle chamber a continuous arch, with the combustion chamber above and return flues below, whereby with producer gas a very uniformly-increasing temperature can be maintained. Suitable sealing in this case is necessary. The application of surface-combustion heating has been made to patenting furnaces in America, whereby it is so well controlled that closed muffle chambers are not needed, the wires passing openly through the heating chamber itself, and no excessive oxidation is produced. In this way three separate pyrometers generally record—for, say, 0.75 per cent. carbon steel wire—ingoing temperature of 550 deg. C., for about two-thirds of the length 760 deg. C., and an exit temperature of 840 to 860 deg. C. Heavier rods may need slightly higher temperatures, but miscroscopical examination reveals that it is possible to attain too high a temperature with such a steel, and too high an excess over the critical point is not always desirable, as it can easily entail too slow a cooling rate through

(*Continued on page 96*)

HIGH EFFICIENCY MULTIPLE

WIRE DRAWING MACHINES

FOR ALL METAL WIRES

EXTRA HIGH SPEED FOR COPPER, BRASS, AND BRONZE, ALSO FOR IRON, STEEL & OTHER ALLOYS

Made in a LARGE RANGE of MODELS to draw from HEAVY ROD to the FINEST SIZES either IN COIL or ON REEL. Large numbers in use in All Countries. Patented in Europe and America.
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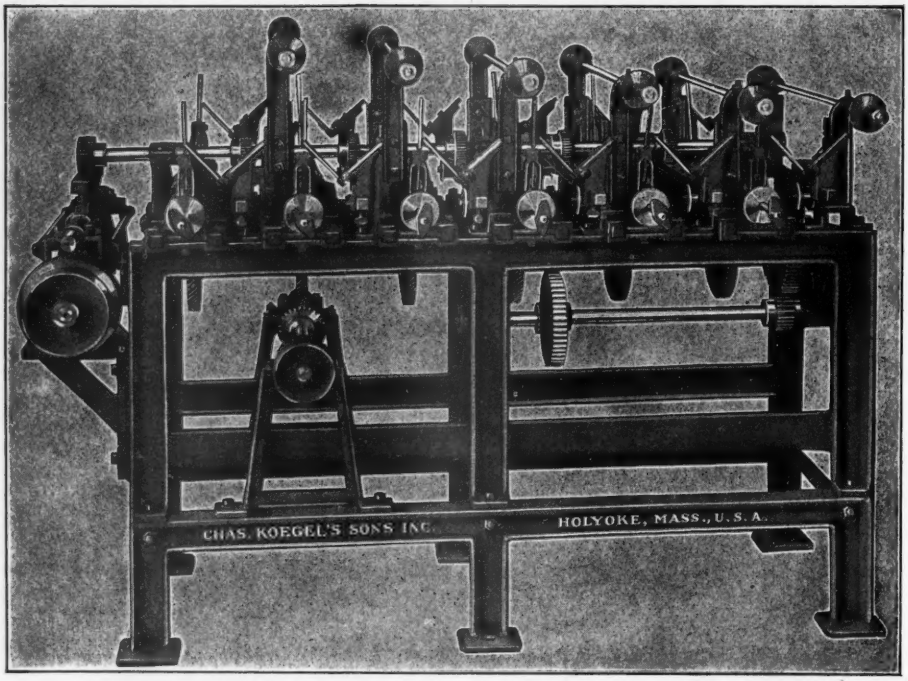
6″ Diameter Spool Capacity
Equipped with or without motor drive



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(*Continued from page 94*)

the recalescence point, with the consequent appearance of some free ferrite, and harmful laminations of pearlite, which interfere with the best possible properties, after drawing to a considerable extent.

It is sometimes advisable to patent low-carbon steels for the purpose of attaining high stress and elastic limit properties without resorting to higher carbon than 0.1 per cent., only in this case ordinary air-cooling is much too slow, even for a temperature of 960 to 980 deg. C., to retain the fully-dispersed carbide in the sorbitic condition, and immediate immersion of the rod as it emerges from the furnace and passes into a water trough is necessary to ensure this suitable structure. Too high a temperature induces the brittle needle structure of pseudo-martensite, even in this low-carbon material, and temperatures below 950 deg. C. do not effect the necessary dispersal of the carbide uniformly throughout the rod within a reasonable heating time.

Another method of producing patented wire in medium- and high-carbon rods is to employ a gas-fired beehive oven, in which the whole length is mechanically wound on to a fireclay bollard, and maintained at a suitably high temperature, about 950 deg. C., for about 30 min. before being withdrawn quickly on to a collapsible "swift" through a trough nearly 100 ft. long, and provided with alternate heaps of sand and free spaces to bring about the necessary rapid cooling to retain the sorbitic structure in the large-grained crystals in the material. The last part to emerge is naturally somewhat longer in the furnace than the first portion, and as it is the first end in, it is earlier subjected to the high temperature, but with care it is possible to get remarkable uniformity by the personal attention of the workman.

Galvanising

This is one of the most commonly adopted processes of making a protective coating adhere to the surface of drawn wire, and considerable skill is needed to produce the most desirable form of continuous covering. The first essential consists in thoroughly cleaning the surface of the drawn wire, which may require to be partially softened by a tubing process prior to the acid dip often used to carry forward enough chloride to make the nascent flux on the top of the spelter bath. After immersion in the hot spelter for a period which depends upon the thickness of the wire, it is withdrawn through some form of wiper to remove surplus coating, the looser texture surface coming through a layer of charcoal covered by moist sand, and the denser skin being produced by passing through a tight asbestos pad held in a comb, before the wire passes on to the winding frame of twenty or thirty blocks (Fig. 4).

Not only is the proper temperature control of the tubing furnace an important item, but the spelter bath requires to be carefully regulated, preferably by pyrometric control, as an aid to attaining the lowest possible temperature at which the bath will work, and avoiding serious trouble, even to the extent of pulling the bath through the end wall of the brick furnace—usually fired with coke. As this method frequently leads to irregular heating and local failures in the steel sides of the bath, various methods have been tried to prolong the working life by different forms of heating. In a previous Paper, by Mr. Turnbull, the idea of lining the inner walls of the bath with asbestos sheet was described, and also the use of lead to transmit the heat to the molten spelter.

A later method by the same author has been tried with a measure of success in several works, whereby the firing is done by town or producer gas through tubes let into the bot-

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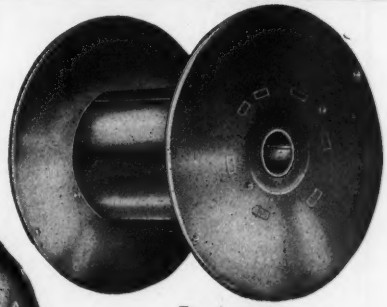

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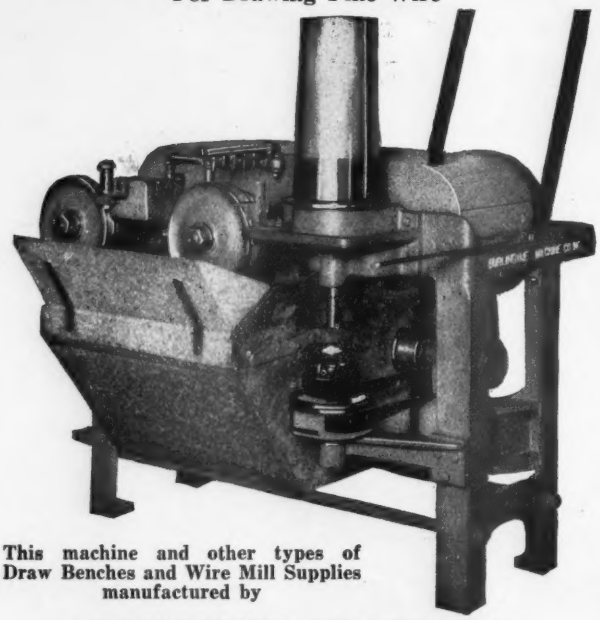
For Drawing Fine Wire



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tom of the bath, and after passing the flame lengthwise through a layer of lead on which the molten zinc floats, the products of combustion pass back round the sides of the bath before passing to the stack. In this way no heat is transferred to the zinc mass through an exposed iron surface, and less dross is produced, with a corresponding increase in bath life. There is still, of course, zinc-iron alloy produced by the carry-over of iron chloride from the cleaning acid. unless precaution is taken —as in some molten processes— to wash the wire free from this contaminating salt, and then to re-coat it with a suitable flux of the zinc chloride, or double ammonium zinc chloride, before entering the spelter bath in as dry a state as possible by passing the wire over a hot plate. Considerable progress has been made in effecting a smoothing of the surface of fully galvanised wire by means of alloy additions to the spelter bath, which mainly act in this way through cleaning the zinc of contaminating oxides, and producing a coating alloy of lower melting point than the pure spelter at the outgoing end of the bath.

Wire-Drawing

The actual process of reducing the diameter of the wire by successive stages is one about which a great deal of empirical ideas exist, and in many cases control production. There is no doubt a great deal of experience lying behind the general principles followed, but improved methods of die production, and better controlled heat treatment of the various grades of steel, have enabled speeds of working and heaviness and continuity of drafting to be much improved within recent times. Good rods to start with, well cleaned and coated, are a prime essential to drastic cold work, but given these there is still a considerable amount of skill required to maintain any particular kind of wire fairly uniform in gauge, and one of the greatest improvements for increased production is the use of individually-driven blocks, each provided with its own motor, instead of the customary line of blocks, gear-driven from a common shaft (Fig. 5). This old idea of Mr. Bedson's has lately been much extended in America, and by using variable speeds the slow pull-in can be followed by a steady increase up to the maximum rate for the amount of reduction involved. The steady pull of the best worm-drive in a single motor block eliminates many of the troubles inherent to the jerky pull of gear wheels.

The proper lubrication of the wire as it passes through the die is important, and is very frequently accomplished by the use of dry soap cuttings carried in a box through which the wire passes prior to entering the hole in the die-plate. Tallow was formerly preferred, and is still used in certain cases for achieving a particular finish on the wire skin; in other cases, for bright work, the wire is drawn wet, either with or without some

such coating as copper flash to suit certain demands on the finished product. One of the troubles inherent in wire-drawing is to prevent the break-up of the material due to "over-drawing," which is often largely a matter of getting the physical state of the wire into the proper grain size before commencing, and in particular a fully patented wire will draw down much further without incurring the internal cuppiness than one less well heat treated. This is especially the case with wire which is even slightly segregated, and for the highest class of rope wire it is also essential that non-metallic inclusions should be few in number, small in size, and as evenly distributed as commercially possible in the high grade of steel used for this most exacting purpose.

Testing

The physical properties of drawn wire afford some peculiar anomalies, some of which have already been mentioned, but in addition to the usual tensile strength and elongation tests, such special tests as torsion on a stated length, and an observation of how the wire behaves under the twisting is frequently used to determine the soundness of the material. Repeated flexions through an angle of 180 deg. over a definite radius is often stipulated as a test of wire to be bent in use, and the freedom from laps and similar defects is generally determined by a wrapping test, either on a certain size of mandrel or even on to the wire itself, a number of "turns" being put on and then removed repeatedly until the wire breaks. Alternate torsion tests are not often called for to detect seams and rokes, nor is the difficulty ascertainable elastic limit determination much asked for, partly because a suitable machine and sufficiently accurate extensometer are seldom available in wire works.

Fatigue tests of wires and wire ropes have been made by certain experimenters, but no very definite information is yet

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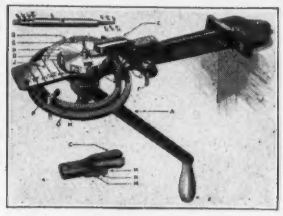

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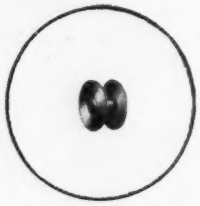

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The American Pulley Company

Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes

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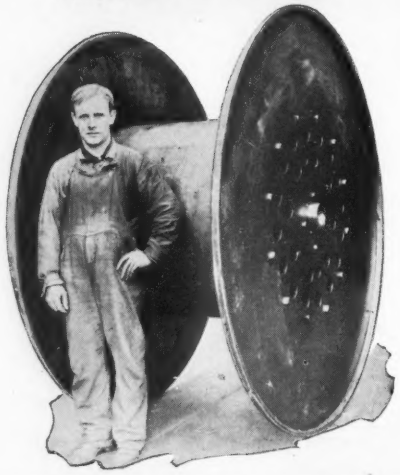
AMERICAN PRESSED STEEL REELS



Metal Spools For Wire Drawing

Metal Spools for Annealing

Metal Lined Spools for Shipping

Metal Lined Reels for Shipping

Hubbard Spool Co.

1622 Carroll Avenue

Chicago

available on this interesting subject. Another useful test for eliminating segregated material is the tensile impact test, which has proved on occasion easily able to distinguish between clean and "ghosty" material, but the method has not been fully developed, although the necessary powerful machines are available. The most critical test of the condition of a wire is revealed by the miscroscopical examination, which with practice is not only able to reveal the source of most failures, but can also be used to speedily ascertain if the structure is in the best possible condition for special purposes, *e. g.*, free cutting, long holing after patenting, sufficiently softened for very drastic single-blow deformation after annealing, bending without springing or cracking, and also for making up into coils uniformly.

Discussion

Mr. Mackenzie was impressed with the views held of the continuous mill, where there were a great number of rolls, and where their speeds must be very accurately timed, because if the following roll was revolving too slowly the piece would build up between it and the next roll, whilst if it was going too fast the piece would be drawn out and probably torn. What happened when the rolls had to be dressed in the lathe, when their diameters would be altered?

Mr. Wingate asked what exactly was the maximum percentage of reduction in cross-sectional area that was got in cold-drawing mild-steel wire before it required to be re-annealed? Some of the reductions in area shown were in the vicinity of 90 per cent., which seemed very high; the resulting tonnage from these also seemed high. In cold-drawing a mild-steel tube quite different results were of course obtained, as in that case there was a rigid stem or mandrel within the tube, so that the metal flowed between stem and die; that was, there were two frictional surfaces, whereas in

wire-drawing, the metal was flowing with only one frictional surface. Even allowing for this, personally he had never managed to cold-draw mild-steel tubes, say carbon about 0.12 per cent., to give a higher tonnage than 40 to 45 tons. He was interested in the type of dies used for wire-drawing. He knew that they used chilled dies, and it seemed now they were using a high-carbon high-manganese steel for the purpose. It would be interesting if Mr. Primrose could give any idea of the respective wearing qualities of these different dies. How long did they retain their size? When pulling a long coil of wire to 14-gauge, was the finished size 14-gauge exactly at the beginning and the end of the coil? Regarding the continuous mill, was there a definite pull from one pass to another? What happened when there was wear on a pass? Was there ever any staving up in the material? Owing to slip in this mill did they ever get the surface of the material chattered, forming a series of cuppy surface defects? He would like to ask if, when highly-cold-drawn mill steel was heat-treated, there was not a tendency to get distinct separation of the carbide round the grain boundaries, unless the material was heated definitely above the upper change point?

Mr. James Mitchell said that in some quarters there was a tendency to blame the steel-maker for attempting to sell that which he ought to crop from every ingot, and he would like to know quite frankly how much of Mr. Primrose's experience really suggested that it was too small ingot discard that was responsible for the trouble experienced.

Mr. Primrose, replying to points raised in the discussion, said, with regard to the redressing of the worn grooves in the rolls, these were long enough to have a number of passes cut in them, and when one set of grooves began to get too big, and threw more work on to the

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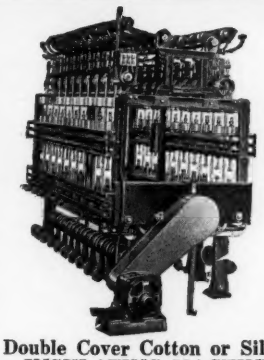
subsequent passes, they could change the line along which the billet was passed. There were fewer grooves in the first rolls where less work was done, and more in the rolls further down the train, so that the line could be changed oftener where the greater wear was experienced. It was only when "gathering" was observed between the guides that it was deemed necessary to change their position, leading the section into a fresh groove, and when these were badly worn after the passage of about 100 tons of material, they could be dressed to take a larger section. The amount of metal which could be passed through before redressing was necessary naturally depended upon the nature of the steel, *i. e.*, soften material with a clean surface from which the scale readily fell off, enabled a longer life to be usefully run by the rolls than when harder steel with higher carbons and tenacious scale was being dealt with. In regard to the wearing out of the dies, it was perhaps not possible to get absolute uniformity of size from beginning to end of a very long piece of wire, but it was considered quite good practice if the back and front ends did not vary more than half a gauge size, for thicker sizes, and about 1/1000-in. for small sizes. It was only when wire varied by a gauge size from beginning to end of a coil that something was deemed to be wrong with the die-hole, which had caused the wire to "run out." It was possible to hold to size chiefly for the reason that the metal of the wire did not actually touch the die-plate, or should not if properly lubricated, though the combination of brown oxide and dried soap which covered the wire as it passed through the die. The friction was thus only due to the shearing of this film of oxide and soap, and this not only helped to keep the wire to size, but also prolonged the life of the die.

In the rolling of red-hot ma-

terial there was always a certain amount of slip, and that helped to mitigate any chance of excessive pull on the plastic material. If they did chance to get any accidental pull on the smaller sections, it would break, because it was comparatively weak in tension at high temperatures. The tendency was rather the reverse way at the ends, where the gauge might be somewhat greater than in the middle. If any gathering did show itself, it was a sign that the line was due to be changed, but he had not seen any evidence of chattering such as had been mentioned; that would be very detrimental to the surface if it should occur, more probably in cold material than with hot steel. Regarding the materials of which the annealing pots were made, it had been suggested to use such high-temperature resistant materials as nichrome, etc., but the cost of a large pot to hold several tons of wire would be prohibitive for treating ordinary material. In regard to the amount of discard, the ordinary percentage in mild steels was usually quite satisfactory. It was only in the higher carbons, 0.5 per cent. and above, that any serious trouble had arisen to a harmful extent, through clearly-defined different-composition material running through a few billets in a cast. The general practice had been to get steel-makers to break the billet from the top end of the ingot back far enough to get rid of what they called the "rose." They realised that no matter how much they cropped off, whether 5 or even 10 per cent., if the steel had a persistence of that segregated pipe beyond that amount, then the billets with that core of higher carbon and non-metallic inclusion material were practically useless for wire-drawing, because of the brittleness of the segregated part. When the fracturing was continued until the "rose" had disappeared, then they could tell that there would be no trouble in the rolling or subsequent drawing from that source.



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MAGNET WIRE
INSULATED WITH
COTTON—SILK—ENAMEL—PAPER
BREGUET HIGH-SPEED
WIRE DRAWING MACHINES

Wire Drawing Soaps and Compounds

STEELSKIN BRAND
(Registered)

For High or Low Carbon Wire
Working Samples sent on request.

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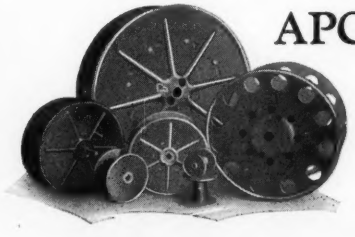
Shipping and manufacturing costs take a decided drop when up-to-date steel bobbins, reels and spools are used.

APCO-MOSSBERG engineers can give you expert advice on your production and shipping problems. Our facilities enable us to turn out the finest all-steel equipment available.



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Specialists in Development of Steel Reels for annealing, Vulcanizing and Stranding; Also Bobbins for Wire Handling.

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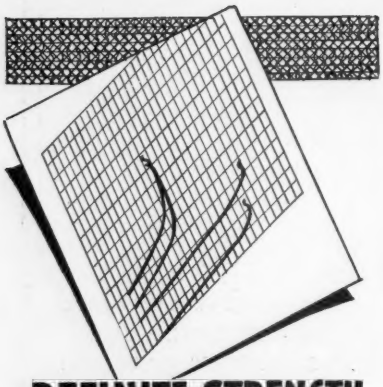

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Permanent graphic charts showing action under stress, elongation, breaking point, etc. on sheets of standard letterhead size to fit typewriter where additional notations, etc. can be recorded and filed. Autographic recorder can be attached to a number of models of Scott Wire, Yarn and Fabric Testers.

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DIAMOND DIES

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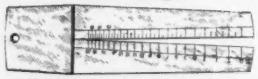
Wire Gauges



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CLEVELAND, OHIO

Broden Construction Co.

Wire Mill and Cold Rolling Equipment

10255 Harvard Ave.
CLEVELAND, OHIO.

Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries

December 1927

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Finland	100	.....	.....	.....	.....	.....
France	.....	.....	.....	.....	.....	335
Greece	.....	.....	.....	1,327	.....	.....
Italy	5,510	.....	.....	.....	.....	.....
Netherlands	100	.....	.....	.....	.....	.....
S. Russia in E.	.....	.....	.....	5,786	.....	.....
Spain	340	.....	.....	.....	.....	.....
Sweden	500	.....	.....	2,092	.....	.....
Switzerland	1,000	.....	.....	.....	.....	.....
United Kingdom	70,817	71,651	.....	1,758	387	69,191
Canada	692,936	1,633,245	13,116	89,511	2,212	12,951
B. Honduras	.....	115	.....	24	.....	1,100
Costa Rica	3,525	.....	65,400	634	101	3,700
Guatemala	933	1,898	162,608	2,093	950	56,448
Honduras	200	5,370	98,999	3,654	.....	34,510
Nicaragua	2,500	2,402	199,485	477	.....	100,140
Panama	782	187	158,550	43,670	33	67,811
Salvador	400	2,511	83,500	412	886	600
Mexico	161,814	131,624	1,298,734	55,531	11,618	50,344
Miquelon & St. Pierre Is.	.....	.....	.....	.....	.....	9,600
Newfoundland & Labrador	255	291	.....	86	.....	2,000
Bermuda	150	.....	.....	792	2,360	.....
Jamaica	3,999	860	1,370	610	155	3,060
Trinidad & Tobago	.....	.....	.....	59	84	5,020
Other B. W. Ind.	.....	45	5,500	.....	.....	7,450
Cuba	32,718	61,846	635,582	107,762	6,189	478,899
Dominican Rep.	8,755	49,048	202,580	4,211	.....	99,000
Neth. West Ind.	248	1,714	.....	4,353	409	12,500
Haitian Rep.	640	522	64,500	904	.....	34,630
Virgin Is. of U. S.	.....	.....	9,500	.....	.....	1,400
Argentina	308,894	860,457	2,043,332	108,107	92	.....
Bolivia	1,000	.....	.....	4,175	.....	100
Brazil	341,789	2,942	879,025	42,874	4,653	.....
Chile	106,805	3,792	72,476	60,366	.....	494
Colombia	65,836	32,742	844,540	21,080	14,153	324,029
Ecuador	1,712	.....	.....	.....	.....	32
B. Guiana	25	.....	.....	.....	.....	.....
Paraguay	.....	.....	.....	.....	.....	1,433
Peru	.....	120,823	265,448	53,142	442	65,899
Uruguay	24,801	64,483	93,500	.....	.....	49,000
Venezuela	180	6,434	84,058	36,758	493	109,186
B. India	.....	.....	.....	10,330	.....	.....
B. Malaya	.....	137	.....	40,580	.....	9,920
China	398,173	.....	.....	2,119	.....	980,760
Java & Madura	500	.....	38,801	9,030	.....	.....
Other Neth. E. Ind.	.....	.....	92,217	48,364	.....	660
Hongkong	.....	.....	.....	.....	.....	1,880
Japan, inc. Chos.	561,969	.....	.....	6,657	.....	5,750
Philippine Is.	10,599	12,936	585,300	120,861	50	453,050
Siam	.....	.....	.....	.....	316	.....
Australia	236,092	35,788	40,300	433	.....	472
F. Oceania	.....	.....	1,669	.....	.....	600
N. Zealand	34,103	71,680	.....	424	2,550	2,709
B. E. Africa	.....	.....	38,400	.....	.....	.....
B. S. Africa	477	212,000	432,075	.....	.....	.....
B. W. Africa	5,693	.....	.....	.....	.....	.....
Other French Africa	340	.....	.....	.....	.....	.....
Liberia	.....	386	.....	.....	.....	10,100
Mozambique	.....	.....	101,000	.....	.....	.....
Canary Is.	.....	.....	.....	.....	85	.....
Total Quant.	3,087,210	3,387,929	8,611,557	891,046	48,218	3,066,763
Total Values	160,176	94,481	241,521	114,722	9,294	88,829

Shipments from the United States to Non-Contiguous Territories.

	6083 Wire		6092 Wire Nails	
	Pounds	Dollars	Pounds	Dollars
Alaska	16,255	2,443	35,674	1,994
Hawaii	97,413	7,703	45,376	1,695
Porto Rico	434,118	23,534	506,751	15,571

Domestic Exports of Iron and Steel Wire Manufactures, Horseshoe Nails and Horseshoes From the United States, By Countries

December 1927

Countries	Woven wire fencing	Wire cloth & screening		Wire n. e. s. & manufactures of	Horseshoe nails	Horseshoes
	Pounds	Pounds	Dollars	Pounds	Pounds	Pounds
Azores & Madiera Is.	.....	.....	.....	384	.....	.....
Belgium	.....	.....	.....	1,696	.....	.....
Bulgaria	.....	987	167	.....	.....	.....
Denmark & Fr. Is	.....	.....	.....	871	.....	.....
Finland	.....	.....	.....	193	.....	.....
France	.....	.....	.....	409	.....	.....
Germany	.....	.....	.....	136	77,339	.....
Greece	.....	.....	.....	5,726	.....	.....
Irish Free State	.....	.....	.....	11,312	.....	.....
Italy	.....	.....	.....	11,331	5,280	.....
Netherlands	.....	390	104	6,526	4,015	.....
Norway	.....	.....	.....	1,749	.....	.....
Poland & Danzig	.....	.....	.....	365	.....	.....
S. Russia in E.	.....	.....	.....	6,935	.....	.....
Spain	18,373	.....	.....	1,078	.....	.....
Sweden	.....	.....	.....	100	.....	.....
Switzerland	.....	.....	.....	146	3,410	.....
United King.	148,367	2,197	616	124,611	.....	.....
Canada	47,850	109,921	41,111	515,272	100	12,943
B. Honduras	2,353	.....	.....	146	.....	.....
Costa Rica	2,222	1,055	201	4,934	1,100	6,700
Guatemala	4,711	.....	.....	7,150	4,700	.....
Honduras	893	6,648	851	1,246	622	650
Nicaragua	513	640	173	897	.....	600
Panama	3,655	1,320	129	8,096	118	3,182
Salvador	976	.....	.....	65	.....	.....
Mexico	109,588	21,459	3,821	263,204	18,629	8,321
Newfoundland & Lbr.	.....	.....	.....	42,030	.....	.....
Bermuda	.....	6,887	489	2,672	.....	1,660
Barbados	880	.....	.....	600	.....	.....
Jamaica	880	.....	.....	600	.....	.....
Trinidad & Tobago	1,176	3,968	563	63	.....	.....
Other B. W. Ind.	17,704	145	27	1,192	.....	.....
Cuba	42,460	21,409	4,159	163,830	17,698	5,600
Dominican Rep.	1,962	8,909	1,037	13,897	213	1,687
Neth. W. Indies	12,892	.....	.....	2,588	.....	.....
Haitian Rep.	170	1,186	297	1,618	.....	.....
Virgin Is. of U. S.	110	65	32	360	25	100
Agentina	23,500	9,258	1,623	31,156	1,980	.....
Bolivia	.....	8,325	1,386	351	.....	.....
Brazil	11,484	864	172	156,918	.....	.....
Chile	4,066	19,320	2,824	14,793	4,488	1,600
Colombia	10,380	10,888	2,281	10,628	23,050	.....
Ecuador	.....	1,060	184	551	3,012	4,400
B. Guiana	396	.....	.....	.....	.....	.....
Peru	1,030	1,068	136	12,269	2,500	.....
Uruguay	.....	1,200	287	4,723	.....	.....
Venezuela	3,571	9,919	1,646	6,551	2,400	.....
B. India	84,369	4,136	645	3,902	720	.....
B. Malaya	44,732	1,750	997	1,084	.....	.....
Ceylon	.....	568	357	834	.....	.....
China	1,510	9,159	1,800	40,338	5,045	.....
Java & Madura	.....	2,354	1,365	534	1,000	.....
Hongkong	.....	.....	.....	153	.....	.....
Iraq	216	.....	.....	.....	.....	.....
Japan, inc. Chosen	11,622	14,289	2,658	147,505	45,878	.....
Kwantung lsd. Ter.	.....	23,787	3,681	1,425	.....	.....
Philippine Is.	14,386	24,557	3,844	30,331	15,750	74,520
Syria	.....	.....	.....	284	.....	.....
Australia	1,799	15,499	2,977	209,508	7,250	.....
F. Oceania	.....	125	24	515	.....	.....
N. Zealand	.....	3,576	1,068	25,305	3,750	.....
B. S. Africa	415	14,524	3,085	4,448	1,980	.....
B. W. Africa	.....	.....	.....	255	.....	.....
Morocco	.....	.....	.....	5	.....	.....
Mozambique	4,380	980	165	2,430	.....	.....
Belgian Congo	.....	6,589	1,250	.....	.....	.....
Total Quant.	636,981	373,520	.....	1,915,519	252,052	121,963
Total Values	33,517	.....	88,463	171,863	26,988	8,189

World's Finest Wire Cloth

(*Continued from page 84*)

large laboratory. After overcoming many difficulties, a piece of 200-mesh cloth 34 in. x 100 ft. was completed, using this special metal of a diameter of 0.0021 in. From that time on Europe has had American competition.

To Scotland belongs the credit for having made the first wire cloth which was many years ago. The first to be made in the United States was made in Belleville, N. J., a little over 100 years ago, by some Scotch immigrants. It is said that one of their old and original hand looms is still in operation.

Modern Equipment
for
WIRE DRAWING
WIRE INSULATING
WIRE STRANDING
Cabling and Laying up Machines
Complete Equipment for the manufacturing of Conductor Cable and Wire Rope
WIRE MACHINERY CORP. OF AMERICA, INC.
FORMERLY
New England Wire Machinery Co
Designers & Engineers
NEW HAVEN, CONN.

WIRE DRAWING DIAMOND DIES

Over 30 years experience in this line. The best equipped establishment in America with modern methods and machinery.

New way for re-inforcing the diamond.

(U. S. Patent 1,624,027. April 12, 1927.)
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JERSEY CITY, N. J.

The Waterbury Wire Die Co.

Diamond and Chilled
IRON DIES
DIAMOND TOOLS

Waterbury, Conn.

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Sleeper & Hartley, Inc., Worcester, Mass.

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Morgan Construction Co., Worcester, Mass.
Standard Machine Works, Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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M. A. Irmischer, New York.

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Hallden Machine Co., Thomaston, Conn.
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Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson.

MACHINERY—Spooling
American Insulating Machinery Co., Philadelphia, Pa.
M. A. Irmischer, New York.
Chas. Koegel Sons, Co.

MACHINERY—Panning
American Insulating Machinery Co., Philadelphia, Pa.

MACHINERY—Testing
Herman A. Holz, New York.
Riehle Bros., Phila., Pa.
Henry L. Scott Co.

MACHINERY—Winding
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Philadelphia, Pa.
Broden Const. Co., Cleveland, Ohio.
Burlingame Machine Co.
Kratos Wks., N. Y. C.
Morgan Construction Co., Worcester, Mass.
M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Mfg. Co., Worcester, Mass.
The Vaughn Machinery Co., Cuyahoga Falls, Ohio.

NEUTRALIZING COMPOUNDS
Oakite Products, Inc., N. Y.

REELS—Annealing
American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

PRESSES—Rivet & Bolt
M. A. Irmischer, New York.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

SPOOLS—Wire & Cable
American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

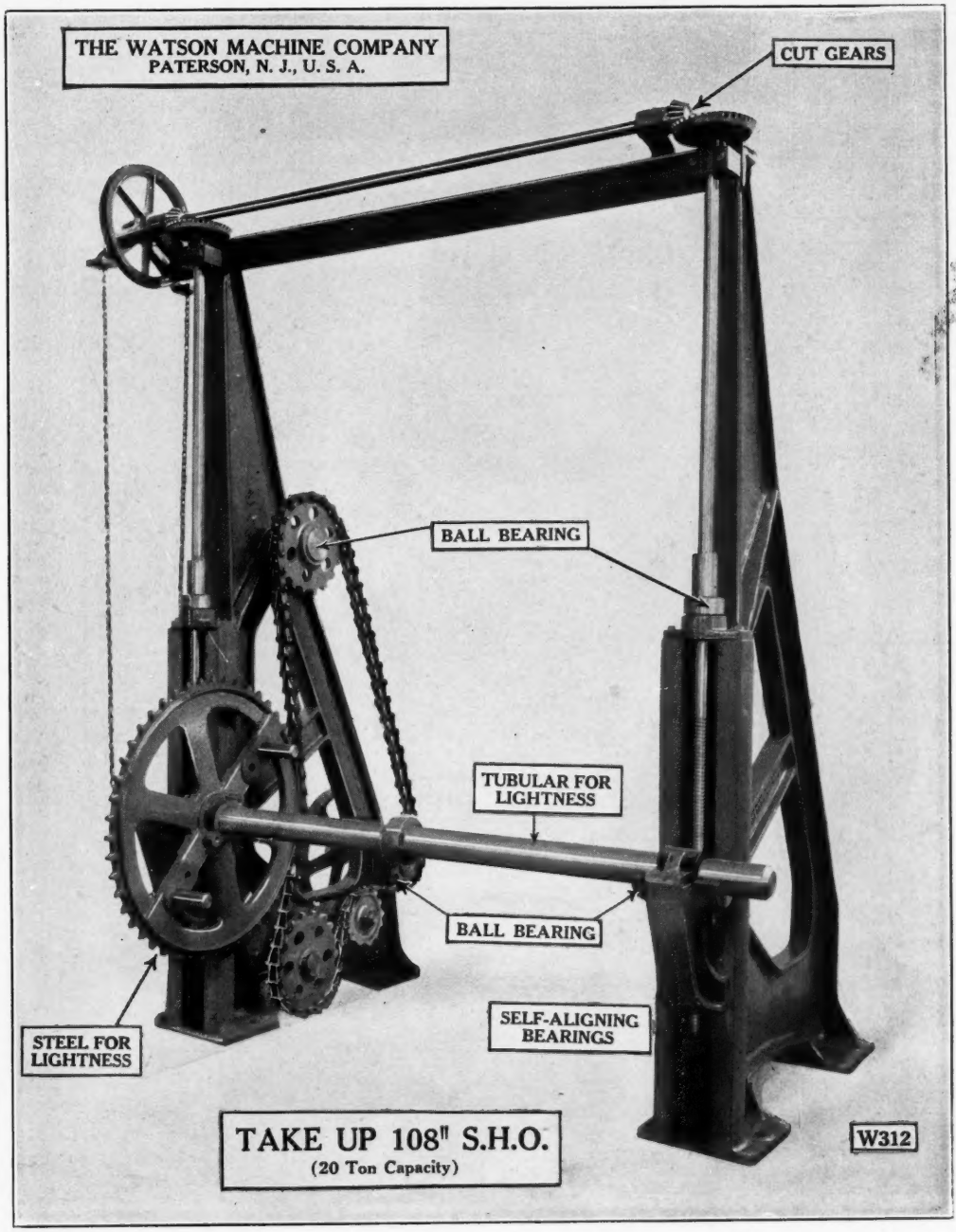
TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

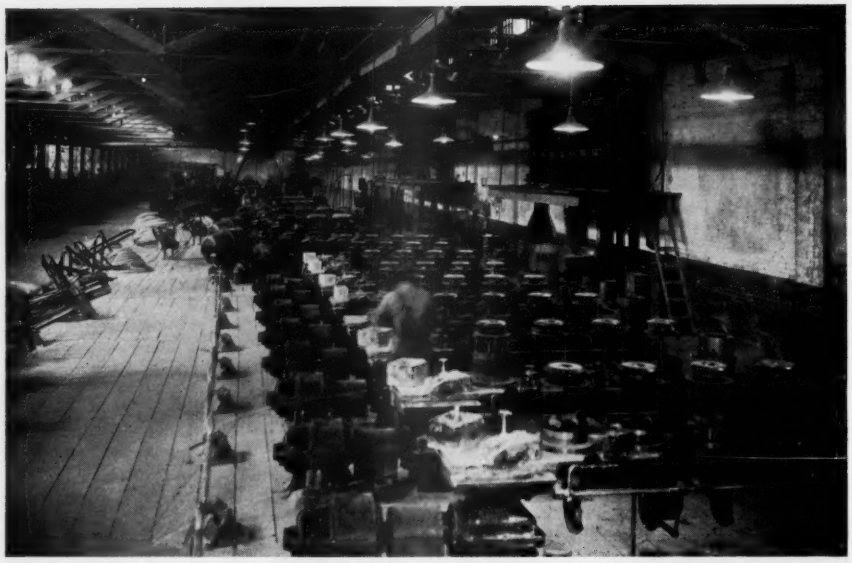
PATERSON, NEW JERSEY, U. S. A.



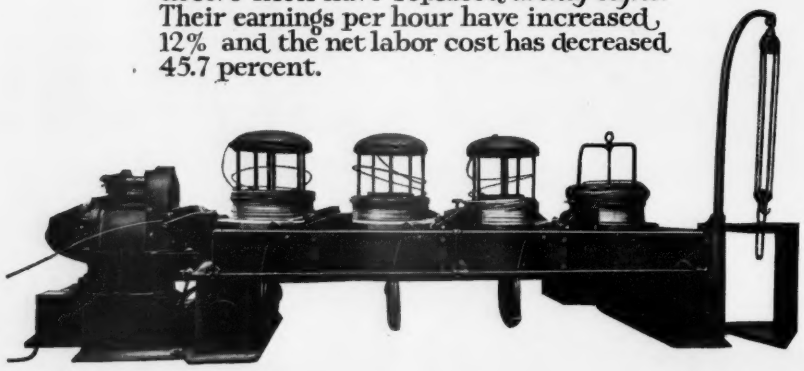
ALSO BUILT IN 72" SIZE

ELECTRICAL WIRE AND CABLE
WIRE ROPE and CORDAGE MACHINERY

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS



Through this installation of
Morgan Connor Wire Machines
twelve men have replaced *twenty-eight*.
Their earnings per hour have increased
12% and the net labor cost has decreased
45.7 percent.



MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS, U.S.A.